PERSONAL
EVERY THURSDAY
COMPUTER
NEWS
45p SEPTEMBER 15-21 Vol 1 No 28 THE COMPLETE COMPUTING WEEKLY

THIS WEEK

THE SINGING SPECTRUM
PCN Pro-ject: Build your own sound generator

IBM MOUSETRAP
We Pro-test two new mice devices

NEWBRAIN CP/M
Exclusive test of the system that could save the Newbrain

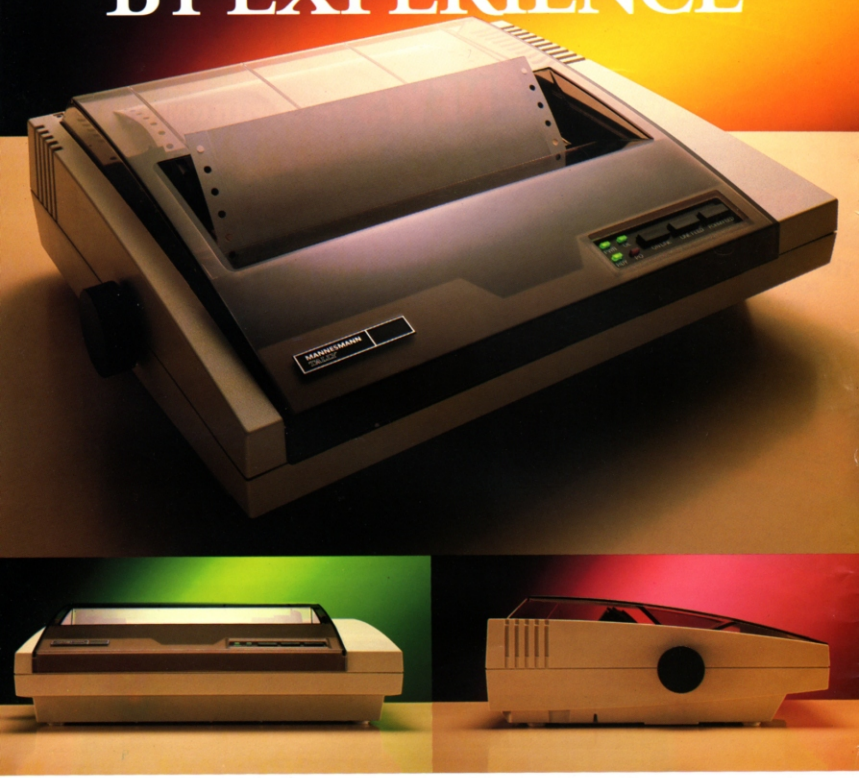
DRAGON MICROPAEDIA
Part 2: Business, music and speech on the Welsh micro

EVERY WEEK

PCN SOFTWARE
We review new packages for business and home use

ROUTINE INQUIRIES
Ask *PCN* — we'll solve your micro problems

THE MT80. SHAPED BY EXPERIENCE



You are looking at the sleek, ultra modern lines of the latest dot matrix printer from Mannesmann Tally; the people who probably have more experience in computer printers than just about anyone.

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MENU
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Pull-out and keep

Micropaedia Dragon: Part 2

Sound, business software, Machine code — plus Droid Wars. Take charge of your Dragon!

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Spectrum load hitch

By Chris Cunningham

Sinclair Research has made a change to the Spectrum that may stop the machine loading much of the software that exists for it.

It is already clear that not all the software written for earlier Spectrums will run on the new version. But the full extent of the problem is not yet evident, and it could give problems to users, software writers, and makers of peripherals.

Sinclair Research's main modification to the Spectrum makes the machine compatible with a wider range of domestic television sets. But it can also cause spurious results from systems connected to the machine's earphone port.

The machine that appears to be a potential source of problems is the Spectrum 48K Issue 3, released in July with a redesigned uncommitted logic array (ULA) chip. The ULA controls the computer's external ports. One result of fitting the new ULA into the machine is a change in the data read from the earphone port — the entry point for programs read from cassette or for inputs from peripherals such as light pens.

Sinclair Research admits that 'an unintentional effect (of changing the ULA) does affect some software.' The firm adds that it has found problems with software written for earlier versions of the Spectrum — 'but not software from major suppliers.' However, the Spectrum Issue 3 is relatively new; it is likely to be some time before the full effect of Sinclair's changes on software written for earlier versions of the machine becomes evident.

The problem seems to be this: in earlier versions of the Spectrum, the earphone port is port number 255, with the sixth of the eight bits that describe the number set logic high (or 1); in the Issue 3, the sixth bit is set to logic low (0) when the machine is first switched on (although in some cases it drifts to logic 1 as the machine warms up).

If a piece of software, either from an applications program, or from utility software used to control a peripheral, tries to read the byte that describes the port, the number it returns is likely to be out by 64 (the value of the sixth bit).

If software does not read the port's number with an IN command, it is unlikely that there will be any problem. If it does, software loaded may crash.

People who buy 48K versions of the Spectrum can check for potential problems by first determining whether or not the machine is Issue 3. Inside these machines, the main circuit board should be marked 'Issue 3' and the computer's heat sink runs across the top of the user port. (In earlier versions, the heat sink is located at the bottom right of the machine's interior.)

A software check will confirm that the machine is equipped with the new ULA:

```
10 PRINT IN 57342: GOTO 10
```

When the line is RUN, the machine should display a row of 255s. If it displays 191, then the new ULA is to blame.

Rumours of problems with the new Spectrum are spreading around the software industry. Some software houses told *PCN* that they have not yet been able to obtain Spectrum 3s to check their software.

Others have made changes to the code in their programs to take account of the new value of the earphone port. And one hardware manufacturer — DK Tronics of Saffron Walden — will supply extra checking software for its light pen for use with the Spectrum, and is considering changing the connecting port for the light pen to one that bypasses the ULA.

Liquidator seeks buyer for Newbrain

The liquidator picking up the pieces at Grundy Business Systems (*PCN, issue 27*) was hoping to start talking to potential Newbrain rescuers this week.

Timothy Harris of Deloitte, Haskins and Sells was appointed at a 'fairly orderly' creditors meeting on September 8. The unsecured creditors, who have less chance of seeing any of their money back after the Grundy collapse, numbered 285, and were owed just under £2 million in all. The company's total debt was put at close to £3.5 million.

But at the meeting they declared their faith in the Newbrain, 'if only a serious and sensible management team could aim it at the targets it was designed for,' one creditor said. A spokesman for Deloitte hinted that there could be such a team in the offing.

Again, no names have been mentioned, but the Computer Traders Association consortium is hoping to bid for rights to the Newbrain and Grundy's Dutch Newbrain dealer is also thought to be interested.

The meeting revealed that Thorn-EMI, which manufactures Newbrains, was left £940,000 out of pocket by Grundy's fall, and Peachtree, with software due to go on the CP/M systems, was owed £178,000. But the vast majority of the unsecured creditors were small businesses and dealers who can less afford to take a loss. A creditor at the meeting said that at least a dozen speakers from the floor expressed disgust that both the Grundy Group and the British Technology Group had washed their hands of the Newbrain.

Toshiba twins arrive in UK

Toshiba's T100 is now on sale in this country — and it has been joined by a big brother, the T300.

The T100 (*PCN, issue 2*) is a Z80 machine which runs CP/M, and comes in various configurations, with a starting-price of £1,495. But the T300 is a newcomer, and yet another 'IBM compatible' machine.

It's intended for various specific types of user and will be sold by Scan Computers with its business programs such as Solomon, the solicitors program, or Buildax, a management suite for the building trade.

The T300 will run CP/M86 and MS DOS with all the programs that go with these two, as well as the Oasis-16 operating system, which Scan also distributes.

The machine has much the same spec as many other 'compatibles'. 6MHz 8088, 192K RAM expandable to 512K, one or two 640K 5¼in floppies and/or a 10Mb Winchester, RS232 and Centronics interfaces and the rest, and it's yours for 'just under £2,500'.

Various add-in cards are (or will be) available, including two graphics adapters, with the model II coupled to the Pallette Adapter.

Toshiba T300 — IBM-compatible.

Franklin to fight on in Apple case

Franklin Computers will not go down without a fight in its legal dispute with Apple. New Jersey-based Franklin aims to continue its case, following its defeat in an appeals court last week to prove that it did not filch operating software from Apple.

The issue is developing into a test case to include software burned into silicon within copyright laws that cover programs held in other forms.

Although the case against Franklin is just one of a sheaf of writs stretching from Canada to the Far East that Apple has taken out against its imitators, it is certainly the most novel application of copyright law yet to apply to the micro industry.

Observers of the industry believe that, whatever the final outcome of the dispute in federal courts, a lengthy spell of litigation will spell the end for Franklin — dealers who might also face an action from Apple could be too frightened to continue stocking Franklin's computers.

But Franklin says it has taken a straw poll of dealers. Although the retailers are keeping a close eye on proceedings, they are still taking and selling Franklin Ace computers. But they and the software writers will be treading carefully.

Dragon's back

Dragon Data looks to have bounced back from the upheavals of two weeks ago (*PCN, issue 27*) as it prepares itself for the Christmas rush.

To signal its return to full fitness it has taken on ten more people, most of whom will work in manufacturing.

According to Richard Wadman, sales and marketing director, the company expects a big increase in demand in the months leading up to Christmas — perhaps 60 to 70 per cent of its sales for the year.

On the manufacturing front, Dragon is thought to be on the verge of producing a 64K machine, although it would not confirm this. The larger system will be particularly important to its push into the US, where machines like the Commodore 64 sell for around $200. In the New Year it is expected to start producing a business system, and Dragon insists its cash flow problems this month did not affect its development of new systems.

TRS shock

By Geof Wheelwright

They say an elephant never forgets, but the giant Tandy Corporation seems to have fallen short in the memory department.

The company miscalculated the demand for 24K and 32K versions of its book size portable Model 100 computer and is now only able to supply the unexpanded 8K-machine. But Tandy UK's managing director said that the wait should soon be over as Tandy ships out both upgrades and ready-built 24K and 32K machines next week.

'We've oversold what we originally projected,' said managing director John Sayers. 'And we certainly underestimated the demand for the bigger machines.'

Mr Sayers made it clear that the company still has lots of 8K machines in stock and that the extra memory chips should be arriving next week to upgrade them.

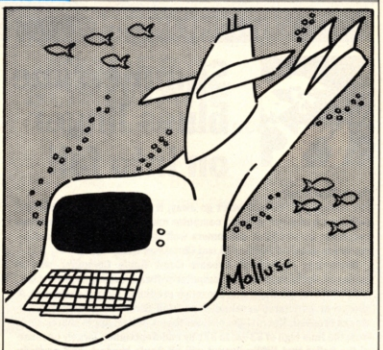
The lack of extra memory on the Model 100 can be a real drawback as it contains several built-in programs (a word-processor, address book, schedule book and telecommunications program) which will each use most of the memory easily once a couple of data files are attached to them. If, for example, you've got a reasonable-sized list of addresses, a couple of form letters and a one-week schedule in memory the 8K is virtually eaten up.

Meanwhile in the US, Tandy is expanding the memory of its Color Computer range. Radio Shack (the name Tandy goes under in the US) has announced the release of a 64K Extended Basic Color Computer for $399.

The announcement of the Radio Shack 64 machine will be of some interest to Dragon Data, which has just concluded a deal to launch a 64K version of the Dragon in the US. Like the Dragon, the new Tandy machine will come with a typewriter quality keyboard. It will offer Radio Shack's long-fabled OS-9, which not only frees all of the machine's 64K as user RAM but also includes a CP/M-style operating system, a text editor, a 6809 machine code assembler and a machine code debugger.

The OS-9 will sell separately for $69.95 and an Extended Basic to go with it will cost $99.95.

Tandy's cut-down colour computer is due to appear in the UK next month.



BBC rig battles North Sea

If you have spare capacity on your satellite dish, you might like to network with what has to be Britain's most northerly user group — on board the *MSV Stadive*, currently bobbing about the North Sea's Brent oilfield.

At the moment, some 30 'frustrated professionals' crowd around a BBC B on the diving support vessel. But the group tells us it is giving serious thought to doubling its installation and is looking for a disk drive.

For more details on how to fit a Centronics interface in a 20 metre wave, or if you are planning a flying visit (helicopters only, please), you can contact the group's spokesman, Ian Wilkins, c/o Brent Field, East Shetland Basin, Northern North Sea.

Oric drives

Disk drives are on their way for the Oric 1.

The drives will be launched by early October, according to an Oric spokeswoman. They will be the Hitachi 3in units, already available for the BBC micro from AMS, and they should be priced at just under £200.

From a user's point of view the capacity of the drive is 100K, but the disks are reversible and offer a total of 200K — to use the second 100K you have to take the disk out of the drive and turn it over.

Oric's advertising of the disks may have been premature but it seems to have avoided some of the problems that have afflicted other manufacturers this summer.

Teaching the teachers

Primary school teachers who've been baffled by micro talk can now breathe a sigh of relief — a new publication, *Primary Teaching and Micros*, is on its way.

The magazine aims to illustrate the ways in which computers can be of value in the classroom. A spokeswoman for the magazine said: 'It will have very practical material for primary school teachers showing how micros can fit into the curriculum.

'Primarily the magazine will have material on the BBC, Research Machines' Link models and Spectrum, which have been given the Government stamp of approval.'

On-line 1-2-3 to mainframes

Users of the 1-2-3 package on the IBM PC can now link into an IBM mainframe and get a host of additional software packages.

Management Science America (MSA) (0628-39242) has brought out an advanced version of its Executive Peachpack which is designed to allow IBM PC users to hook into IBM mainframes running on MSA online systems and to exchange data.

For a cost of £4,000 you get a plug-in board for the PC that provides the circuitry to allow the PC to talk to the mainframe computer. In addition you get a bundle of software produced by MSA under the Peachtree label.

Included in the Executive Peachpack are the PeachCalc electronic spreadsheet, PeachText (a word processing package), Business Graphics, List Manager (a mini-personal database), telecommunications links to other micros and PeachLink for the mainframe link.

The new enhancement is an admission of the success of 1-2-3.

BLACK NESS — Inside this little black box is a programmable cassette recorder controller for Spectrum users. NMS Tape Control plugs into the Spectrum's EAR and MIC sockets and is activated by simple Basic commands, either direct from the keyboard or under program control. For £21.45 up to two recorders can be used with the controller, and in addition it also carries out SAVE/LOAD lead switching. For extra boost in games playing there's also a built-in beep amplifier with volume control. Contact Ness Micro Systems, 100 Drakies Avenue, Inverness IV2 3SD.

Smaller Sord

By Richard King

A new range of battery-powered, lightweight and truly portable microcomputers with advanced features looks set to follow in the footsteps of the Tandy Model 100.

Sord, the company which openly proclaims an intention to become the biggest computer-maker in Japan within a few years, seems to have a challenger on the blocks.

The Sord IS-11 has a proper, full-size keyboard, a 40 × 8 liquid crystal screen and a built-in micro-cassette drive. Memory-size is expected to be 64K.

Apart from these useful features there are at least two add-on modules which plug into either side of the machine.

One is a printer, which would seem to use the small pen-plotter mechanism used by Tandy, Oric and Sharp. This goes on the left-hand side.

On the right-hand side a calculator-module can be connected. This has a calculator-type keypad, placing the machine astride the calculator/hand-held computer markets.

As yet only a Nipponised version is known, but the machine should appear in the UK early in 1984.

A series of other machines is also coming, ranging from the M-68, which should be available very soon, up to an as yet unnumbered '32-bitter', due next year.

Eventually Sord will have several complete ranges of machines.

VIEW FROM AMERICA

Summertime blues linger on into fall

From Chris Rowley

The summer of '83 just won't go away, it seems, and in the blazing doldrums a number of home computer makers have seen their sales evaporate as computer consumers wait to see 64K RAM and colour machines unveiled for the fall and Christmas rush.

Meanwhile in Federal Appeals Court Apple Computer won a landmark decision giving all computer software copyright protection.

At first though, there was the much predicted August shake-out. A chorus of punctures resounded on Wall Street as microcomputer stocks crashed. Not just the obvious losers either; Apple shares sank from the June high of 63¼c to 37c by mid-September, largely because of the belief that IBM's Peanut will hit Apple hardest, and partially because Apple put off the long-awaited Macintosh release until January.

Apple began rising again on the rumour that IBM has put back the Peanut until 1984. Clearly there is a belief that the slightest slip could be fatal. But the shake-out continues, and though Commodore is enjoying brisk sales of the 64, the Vic 20 has joined the Timex Sinclair 1000 and the Texas Instruments 99/4A among machines classified as 'dead in the water'.

Basically the American computer consumer has had it with cheap machines that hurt the head to use and don't remember much. No wonder the Commodore 64 does so well, especially at $200.

A popular $800 set-up has a 64 with a disk drive married to a 30 cps dot matrix printer and word processing software. This makes a neat match with what American computer consumers already own — the colour TV. So natural a match even induced Tandy to bring out a 64K RAM colour computer of its own which will retail for a somewhat whimsical $400.

More interest is focused on the new Ataris and the Coleco Adam. Atari must win to live, and further executive shuffles were announced there this week. Coleco is clearly on a roll. Having moved about 500,000 $150 video games in the past year it has cut all video game manufacture and switched capacity to turn out the Adam, which now has a marketplace ETA of October 1 and a predicted price of $700 or less.

There are said to be 400,000 Adams on order, including machines designed to incorporate the existing Coleco video sets. Fears that making that many units will be too much for Coleco to handle sent its stock sliding 17 points from a summer high of 60. Coleco announced, however, that it has redesigned the Adam to boost the special tape drive speed to a level comparable with that of low-priced disk drives.

With 80K memory and its 10 cps printer, Adam offers home word processing plus access to Coleco's excellent games.

Meanwhile, in Philadelphia Federal Appeals Court, Apple won a big decision that could finally gain copyright protection for all software. 'The medium is not the message' wrote the court and the software industry breathes a sigh of relief.

Now Apple has copyright on ROM programming that was used by Franklin for its big selling Apple clone the Ace Computer. Franklin will appeal and Apple will seek an injunction to suppress the Ace.

The case may even go to the Supreme Court, but on the basis of this decision a lot of legal activity can be anticipated. Furthermore, a number of publishing corporations can be expected to take the plunge into the software lagoon.

Bundling and integrated software seems to be the wave of the moment. Good examples are Kaypro's 'Perfect Software' and Peachtree 'PeachText' 5000. Both offer a box of disks covering WP, spreadsheet, filer, speller etc for $400, or in Kaypro's case for free since it comes with the machine.

For the IBM PC the top seller is the Lotus 1-2-3, which has sold 50,000 copies so far. These integrated packages usually offer a 50% saving over individual program purchases, so they're taking a hefty slice of the total software market.

Calling the tune

The portable Pied Piper encased in an unportable console.

The Pied Piper bottom-line business portable has at last made its début at a price of £1,225. *PCN* first looked at this CP/M system way back in issue 4, April 8.

The Pied Piper is about the size of a briefcase and weighs less than 15lbs. It's a 64K RAM, Z80 system with a full keyboard and a single 800K disk drive. A standard CP/M machine, it comes with Perfect filer, writer, speller and calc as free software. The machine requires a separate monitor, although £28 buys an RF modulator to connect it to a TV.

Further options include a second disk drive (that's small enough to carry around with the machine) for £332. A dual RS232 interface is £115 and a printer cable £57. Planned developments include a modem and a hard disk.

Semitech Microelectronics, the machine's Canadian manufacturer, sees the Pied Piper as a mass market machine. But it may have lost its edge since it was originally announced. Heavy discounting on machines like the Osborne (which offers twin drives and a built-in monitor) and new yet-to-be-seen machines like the Advance 86 will be stiff competition.

ZX81 targetted on China

Sinclair Spectrums are about to cross the Bamboo Curtain — and the ZX81 could get a new lease on life in the process.

Sinclair Research is shipping 'small quantities of components' for local assembly in the Peoples' Republic of China. This will be a trial process. If all goes well it is hoped that Sinclair will sell large numbers of socially built ZX81s and Spectrums in China, but the company could not say last week when the results of the trial might become known.

The number of people using home computers in China is not known. More to the point as far as Sinclair is concerned, the number of television sets in the country is thought to be very small. The components being shipped in during the trial will be standard, with English language keyboards and software.

Chinese technicians are due to visit the UK to look at assembly techniques, but reports that the Chinese are committing £10 million to the exercise were dismissed by Sinclair.

Sinclair has voiced the opinion that the ZX81's life expectancy may be extended by moving it into under-developed markets when Western markets are saturated, and indications from such diverse sources as the US and WH Smith suggest that this is already happening. But only cynics will believe that, after the trouble at the Timex assembly plant this year, Sinclair is looking to China for large-volume, low cost, trouble free production.

Artic antics

Users of Vic 20 and Oric systems will find new games in the latest batch from Artic, but the Yorkshire software producer is also branching out into educational software for several systems.

Artic is distributing software produced by a recently formed division of E J Arnold, an educational supplies company. Arnold is a publishing house based in Leeds; its software division is producing material for the Spectrum, BBC Micro, and Apple.

These programs sell for £13.95 and so far there are six titles for the Spectrum and the BBC: Weather Station, Microbug, Beat the Clock, Alpha Graph, Angle Turner, and Animal/Vegetable/Mineral.

Games-starved Oric fans will find Asteroids in Artic's own clutch of new releases. Like the games for the Vic 20, this costs £5.95. The Vic 20 offerings are Scram 20, Frog Chase, Snake, Martians, and something called Connect, which pits you against the machine in an unusually non-violent fashion.

Artic is on Driffield (0401) 43553.

AT&T boost for Adam

Faith in Coleco's ability to deliver its sensational Adam (*PCN, issue 15*) was propped up in two ways last week.

Coleco itself staged a demonstration of the machine to prove that it actually exists, and it repeated the astronomic orders it claims to have taken. But more convincing yet is the fact that AT&T, the US equivalent to British Telecom, has joined Coleco in a venture that will deliver games to home users over the telephone.

In the UK Coleco re-launched its Colecovision games unit but the company would not be drawn on when the Adam might be seen here. The system that took the Consumer Electronics Show in Chicago by storm in June will combine a Z80A, 80K of RAM, high-speed tape storage and a daisywheel printer for less than $1,000. Coleco says it has orders for 400,000 and 'commitments' for another 100,000, accounting for all its planned production this year.

But doubts have surfaced recently over its ability to deliver the Adam package. The planned price, $600, went up to $700. The tape storage system has been widely regarded as a liability. And although Coleco appears to be putting all its eggs into one basket with the Adam, it has had to put back its first shipments because it hasn't had Federal Communications Commission clearance for the system yet.

If you already have a Colecovision games machine, the equipment needed to build the system up into an Adam is due to cost $400 in the US. As far as UK users are concerned the same doubt exists as to when and for what price this upgrade will be available in the UK.

Meanwhile Coleco itself has reacted strongly to the rumours surrounding the Adam, claiming that many of them have been the fabrications of journalists who hadn't checked the facts.

Coleco used last week's demonstration to indulge in the Acorn-like tactic of diverting attention from one product by talking about others 'in the pipeline'. It plans a $100 modem, a $150 64K expansion pack, and a $300 disk drive.

The deal with AT&T aims to provide users of home computers and video games machines with a supply of games from the telephone network operator. AT&T is developing a new type of modem.

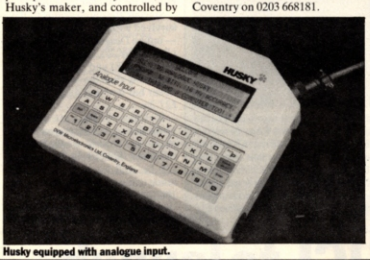
Husky in step

The ever-changing Husky portable has gone through another metamorphosis and has come out with a direct analogue input option.

This latest addition to the Husky's range of functions is intended to make it more attractive to anyone collecting processing data that comes in from devices that give an analogue signal. The analogue input option is fitted by DVW, the Husky's maker, and controlled by applications programs written in the machine's interpreted Basic.

It can be programmed to take readings at times specified by the user, if you want to leave it monitoring a process, or simply plugged into analogue devices for on-the-spot data collection. It uses an internal multiplexor to give a choice of eight separate inputs.

DVW Microelectronics is in Coventry on 0203 668181.



Husky equipped with analogue input.

Three in a bed

EPROM erasers are coming down the price scale with the appearance of a unit that can take three chips at a time.

Ground Control of Hullbridge, Essex (0702 230324) has launched the Uvipac especially for home users who don't need to re-use EPROMs regularly in large quantities.

It costs £19.95, or £24.95 with a timing device.

EPROM processing isn't the sophisticated operation it once was and the amount of equipment available for hobbyists is growing all the time. With the Uvipac all you do is load the chips into a conductive foam pad and insert them into the unit. After a period of between five and 20 minutes, depending on the EPROM type, you remove them and burn something different into them.

With its capacity of three chips (or one CPU with on-board EPROM) the Uvipac might complement JP Designs' eraser (*PCN, issue 25*), which will take from 20 to 40 EPROMs at once.

The working principle of the EPROM eraser is a slow ultraviolet light that resets each of the cells on the chip. There is no great danger in overcooking your EPROMs, but a more common source of development bugs arises from taking them out too soon through sheer impatience. Hence the value of a unit with a timer.

Virgin goes on bus tour

Virgin Games has packed a bus full of hardware and will be taking it round the country between October and Christmas.

On board will be a Dragon 32, Vic 20, Commodore 64, Texas Instruments 99/4A, Spectrum, Oric and BBC. They will be running Virgin's games, including the latest batch of eight new programs, and Virgin plans to have some of its programmers on hand to talk you through the systems.

The new games are Death Cruise — not involving a double-decker bus — Castle Adventure and I Ching for the Dragon, Envahi and Creepers for the Vic 20, Racing Manager and Lojix for the Spectrum, and Killer Caverns for the Oric.

Virgin is on 01-221 7535. Its bus tour dates and stopping points have yet to be finalised.

All aboard — Virgin Games' programmers not forming an orderly queue.

Acorn to build Electron in UK

By Chris Cunningham

The Electron could become the first major new British micro to meet its availability targets — Acorn is bringing its production home.

Acorn will begin British production of the Electron early next year. The increased capacity will 'add substantially' to the current 20,000-25,000 units per month that the company's Malaysian manufacturer is now producing. And much of Acorn's Far Eastern capacity will be released for a Cambridge-based assault on the American market.

Within the next few weeks the company will decide where the second source of the Electron should be. Leading contenders for the production contract are likely to include EB Electronics, Race Electronics, and Keltek, the firms that share production of the BBC B.

Acorn's original decision to build the Electron in Malaysia was based on readily-available capacity and a loophole in EEC tariff legislation — the tariff on components exported to the European community is half that placed on finished goods.

'Acorn prefers to make computers in Britain,' a spokesman for the company told *PCN*. Extra production in the Far East could also open the way for the Electron to join the BBC B in Acorn's current drive into the US. Production of the BBC machine in Hong Kong will be directed mainly towards Australasia and the US.

Acorn is at the moment trying to repeat its success in selling the BBC B in British schools with a full-scale launch in the US.

Lotus blossoms

Lotus, the US company that made a breakthrough in software with its 1-2-3 package (*PCN, issue 4*) plans to set up shop in the UK.

Reflex, a newly-formed distribution company, based in Reading, is setting up a dealer network to sell the company's products. And later Lotus plans to establish a support centre in London, employing 40 people who will give full product support and technical development facilities.

A spokesman for Lotus said: 'Our intention is not just to swamp the market with US software, but to start producing software over here.'

At the moment it's not certain when things will kick off, but Lotus will be one of the first US software companies to manufacture directly in Britain.

Lotus has already established a good name for itself, with products like Visiplot and Visitrend under its belt. And it's best selling package 1-2-3 is said to have made over 60,000 sales since January.

The 1-2-3 program is a financial/management information package which integrates spreedsheet analysis, graphics and database management in one program for several 16-bit machines.

Until now only the US version of the program has been available to users but by the end of September a UK version will be in the shops for an extra £30.

Out of the mouths of Dragons . . .

The Dragon speaks — for an extra £38 or so. JCB (Microsystems) of Bournemouth has introduced a speech module that puts words — from a stored vocabulary, or created by a programmer — into the Welsh micro's speaker.

At the heart of the module is General Instruments' SPO256 speech processor, programmed to call up around 200 complete words.

The SAY command calls up stored words from memory, while SPEAK creates words from speech components, or allophones. ADD combines the two main speech commands, and further commands enable the computer to produce speech and graphics simultaneously.

JCB is on 0202 423973.

Executives still prefer expansion

The image of the big spending American executive is reinforced by a survey of the breed carried out by Frost and Sullivan.

The survey shows that executive users of personal computers in the US spend $1,027 on add-ons in the first year of ownership.

Fortunately the price war this summer has been more savage in the US than here and $1,027 goes further. However, it doesn't buy the study, which costs $1,275.

Memory expansion was a popular item of expenditure — a familiar response to buying a personal computer. But in the US communications were also an early consideration; these were not contacts with bulletin boards but concerned interfacing to larger resources.

Hence not many had added a hard disk, and only six per cent intended to. It will be interesting to see what the take-up rate for the IBM XT is among this class of buyer.

DRUM ROLL — This may not be the cheapest form of hard copy but if you are running a micro in an engineering, design, or research house it may be worth a look. Sold by Sintrom Electronics (0734 875464), the DMP-42 is an A1/A2 drum plotter plus intelligence and memory, and costs £2,360. It has colour only in that the pause command will let you change the pen, but its output is 'virtually' step free because of the micros that control the motion of both pen and drum, and its instruction set gives you the option of generating various shapes and line types with one-line commands. It runs off an RS232C interface at baud rates from 110 to 9,600.

Clive's rise

Despite fierce price cutting in the home computer market, with the cost of machines plummeting, Sir Clive has kept his head well above water with a pre-tax profit of £14 million for the year to March 31.

Sinclair Research seems to have survived without too many hiccups — unlike Dragon Data and Grundy (*PCN issue 27*). And with winners like the ZX81 and Spectrum it's not surprising that the company's turnover has doubled to £54.5m from £27.2m.

Sir Clive still has a few surprises up his sleeve, and early next year he plans to launch a professional computer. Sources say the machine will be well up market from the home computers, but cheaper than the top business micros. He is also due to launch a pocket-size television using a flat screen this week.

Blow your own

Cobol on a ZX81 and your own development lab for £40?

Cambridge Microelectronics has produced an EPROM programmer that costs around £20. With the same company's memory expansion unit at £15 and a couple of 4K memory chips at £3 each, the cost of burning programs onto silicon has hit a new low.

The programmer, Promer-81, is supplied with a control program on tape. The menu-driven program provides screen prompts and common programming commands such as CHECK and VERIFY. The power source is four PP3 batteries.

Camel's ROM-81 expansion module takes two chips (commonly 2716 or 2732 EPROMs) for up to 8K of memory expansion.

From a specialised exercise in hexadecimal programming with very expensive hardware, through equipment comparable in price with a home micro, EPROM programming is becoming one of the cheapest if not simplest routines in home computing.

Blow it yourself — Camel's EPROM programmer plus power supply.

ICL to launch against Lisa?

While software companies try to emulate its functions and hardware makers try to undercut it, Apple's Lisa continues to give everybody something to shoot at.

The latest marksman is none other than Britain's flagship computer company ICL. According to unconfirmed rumour ICL is working on a Lisa look-alike, to be launched next year.

ICL's current systems at the micro level consist of its Personal Computer, a Rair Black Box by any other name, and the DRS (Distributed Resource System) range of interconnecting micros. ICL is saying nothing about its plans, and Rair would only comment last week that its involvement in the development of ICL's product range is continuing.

The Apple system at present costs in the region of £8,500. It is thought that ICL will undercut this by about £2,000, increasing the company's potential for infiltrating the lower end computer market.

It is expected that ICL's next step will be to produce a 32-bit micro at low cost. This could incorporate the Motorola 68020 32-bit processor, which should be available by the middle of next year.

CE NEWS

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HUNT WINS GRAND PRIX

At yesterday's Monaco Grand Prix, a hunting party strayed onto the track at the climax of the race. Cars were halted as the hounds rampaged around the circuit. "The whole place has gone to the dogs," one driver was reported as saying. The race was restarted; riders and drivers battled bitterly around the course before the Hunt thundered past the finishing line to take the chequered flag (it hasn't been seen since).

PLAYER WINS OPEN

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PRIVATE DETECTIVE DISAPPEARS

Police are baffled by the disappearance of Dan Diamond. He was last seen approaching the eerie edifice known as Franklin's Tomb, but the authorities are completely unable to find any trace of him. Citizens are asked to report any information relating to his disappearance immediately. For further details, buy FRANKLINS TOMB, a new adventure game for the DRAGON 32 and 48k ORIC-1. This adventure comes complete with a 24-page illustrated Case File. £9.95 from BOOTS, SPECTRUM, COMPUTERS FOR ALL, WEBSTERS and all other purveyors of quality software. Don't miss it!

BANANA DICTATOR SLIPS UP

El Toro, dictator of

2 DEAD IN EVEREST TRAGEDY

The Everest Expedition ended in tragedy yesterday as Carl and Frec plunged down a crevic to a grisly death. Han the expedition lead was quoted as sayi *"Yuk". Continued on pag*

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EPROM from Watford

Watford Peripherals, which specialises in BBC computer peripherals and software, has launched a number of new products, all made by the company.

The EPROM programmer, which connects to the computer's bus allows you to program all the EPROMs that can be used in the BBC micro. It has its own power supply, connecting lead, ROM-based controlling software package and manual and is on sale this week for £72 plus VAT. The six other products are also due for release this week.

The ROM based Beebmon Debugger is £18 plus VAT and debugs machine code. Its functions include single step, disassemble, memory/register display, break points, relocate, memory modify and several other routines.

The Watford DFS costs £42 plus VAT, and is fully compatible with the Acorn DFS. It is claimed to be an improvement on the Acorn version. The Colour Screen Dump package is £399 plus VAT. It uses a Seikosha 700 dot matrix colour printer, and allows text and high resolution graphics to be printed on normal paper in seven colours or 30 shades. A special ROM can be plugged into a BBC to give a SCDUMP command. Watford says this will give the printer any mode in full colour, including mode 7.

Disk Fix allows screen editing and copying of any part of a disk onto any other part. It costs £19 plus VAT.

Printers link

Printers are no longer simple peripherals — they are becoming output systems with intermediate devices that let you use different types of printer interchangeably.

Dataflex is now selling the Turbo Box 106, an intelligent duplexer which can be used on any micro.

'This will let two micros talk to two printers in serial or parallel mode, all software driven with 64K buffering for about £460,' said a spokesman for Dataflex.

Come October, it will sell the box with an IEEE-488 interface, too. 'This will let you hang more devices on to this box without the hassle of getting the wiring right,' he said. This option will make the box £575 and people owning the original one should be able to get this option added, if they want it.

The unit is built in Sweden by Microtech. Dataflex (01-748 4176) also distributes US software from Ferox. By the end of this month its £460 business package Encore! will be available, initially for the IBM, but later for the Sirius, Apricot and Lisa.

The package, which runs under the UCSD-p operating system, also has a database management function.

Lifeboat sales

Anybody stumbling through software catalogues looking for something to run on their IBM PC will find Lifeboat ready to rush to their assistance.

Lifeboat Associates (01-836 9028) has sent down the slipway a range of utilities and business applications in 16-bit format for the PC. Many of the names are familiar, but brought together they represent the US software supplier's biggest move into the IBM environment.

Of the 22 packages launched last week only one is designed and produced by Lifeboat itself, but this costs less than any of the others and promises to give you a migration route from one type of system to another. Emulator-86 allows you to run programs written for a CP/M-86 system on a machine running MS-DOS. It need not be an IBM PC but Lifeboat expects the IBM machine to be the focus of interest in this utility. it costs £57.50 plus postage and packing.

NWA Statpak, a library of statistics functions, and Halo, a set of colour graphics routines, are both specifically designed for the IBM system running PCDOS. Statpak costs £310 and Halo £115. The remainder will run on any MSDOS system.

Several of the remaining names will be familiar either from 8-bit systems or from original suppliers. Lifeboat has put together quite a collection.

These are Panel, (£258) a screen panel design routine; PMate, (£115) an editor package; EM80/86, (£138) which allows programs written to run under CP/M-80 to go on to an 8086 or 8088 system; UT-86, (£126) an extension of existing 8086 utilities; the communications facilities Ascom (£126) and Bstam (£132); Autosort-86, (£115) a sort/merge/select utility; dBase II (£425); Tim and Fabs-II, (£483 and £167) data handling systems; Lattice-C, (£350) a C compiler, and C-Food-Smorgasbord, (£115) a collection of subroutines; FPL, (£575) the financial management tool, and Unicalc, (£149) a spreadsheet calculator; and the office systems WordStar, T/Maker, Microspell, Math*, and Mailmerge, (£276, £178, £190, £192, and £98).

64 for Thorn

Autumn will see a number of new games from Thorn EMI Video but the new year promises to be more interesting as TEV broadens its scope.

TEV (01-836 2444) intends to concentrate on the Commodore 64, among others.

Until now it has played safe by producing software for Atari and Vic 20 systems. A spokesman said that it might attract criticism by catering for users of US systems but he pointed out that that was where the majority of business was to be done.

In case you felt that games were just a frivolous way of passing the time, TEV has included some social comment in its forthcoming releases. Computer War, based on the film War Games, comes with the discouraging advice: 'If global nuclear war is a game, the only winning move is not to play.' And River Rescue entails saving 'starving and helpless' refugees.

KING RAT — Cartridge software is beginning to surface from Commodore for its machine with a package called Radar Rat Race. In this maze game you control a mouse whose aim is to eat all ten hidden cheeses. You're given some help with a radar screen that pinpoints the locations of cheeses and enemy mice. And if that's not enough to cope with, there are cats ready to pounce. The package costs £9.99 and is available from most leading high street stores and Commodore stockists.

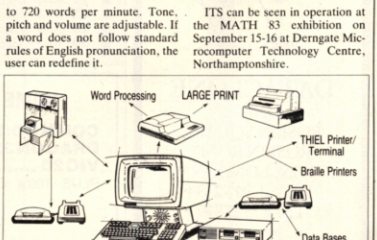
Voice controlled micro

More companies are stepping up their involvement in producing microcomputer products for the handicapped. And in response to the needs of the blind, Maryland Computer Services, in the US, has built a new micro called Information Thru Speech (ITS).

ITS comes with a voice synthesiser and interconnected brailler for the blind or visually handicapped. The system is based on a Hewlett Packard 125 with a Z80 processor, 64K of RAM and CP/M operating system. For about £6,000 you also get a disk drive, a visual display screen and a detachable keyboard.

All voice controls and components are housed in the computer, and the user has an unlimited vocabulary. The rate of speech is 45 to 720 words per minute. Tone, pitch and volume are adjustable. If a word does not follow standard rules of English pronunciation, the user can redefine it.

ITS can be seen in operation at the MATH 83 exhibition on September 15-16 at Derngate Microcomputer Technology Centre, Northamptonshire.



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PCN Charts

This top 30 games list is compiled from both independent and multiple sources across the nation. It reflects what's happening in high streets in the two weeks up to September 1 and, like the micro charts, do not take account of mail order sales. The micro charts this week show the number of machines sold in the two-week period ending two weeks before publication date, so they tell the story in the high street between August 19 and September 1.

Neither mail order nor deposit-only orders are included and the prices quoted are for the no-frills models and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and, like the games, will be updated every alternate week.

PCN Charts are compiled by MRIB (Computers), London, (01) 408 0250.

GAMES

Top Thirty

			GAME TITLE	PUBLISHER	MACHINE	PRICE
▲	1	(4)	Manic Miner	Bug Byte	Spectrum	£6.00
▼	2	(1)	Jet-Pack	Ultimate	Spectrum	£5.50
▲	3	(5)	Flight	Psion	Spectrum	£5.95
▲	4	(8)	Horace and the Spiders	Psion	Spectrum	£5.95
▲	5	(7)	Ah Diddums	Imagine	Spectrum	£5.50
▲	6	(21)	3D Tanx	DKTronics	Spectrum	£5.50
▲	7	(13)	Arcadia	Imagine	Spectrum	£5.50
▼	8	(3)	Tranz AM	Ultimate	Spectrum	£5.50
▲	9	(10)	Penetrator	Melbourne	Spectrum	£6.95
▲	10	(15)	The King	Microdeal	Dragon	£8.00
▲	11	(25)	Gridrunner	Llamasoft	Vic 20	£8.50
▼	12	(11)	Jumpin Jack	Imagine	Spectrum	£5.90
▲	13	(14)	Mad Martha	Mikrogen	Spectrum	£6.00
▲	14	(—)	Kong	Ocean	Spectrum	£5.50
▼	15	(6)	Terror Daktils	Melbourne	Spectrum	£5.95
▼	16	(12)	Krazy Kong	Interceptor	Vic 20	£6.00
▲	17	(20)	Heathrow ATC	Hewson	Spectrum	£5.50
▼	18	(2)	Transylvanian Tower	Shepherd	Spectrum	£6.50
▲	19	(—)	Football Manager	Addictive	Spectrum	£5.95
▲	20	(26)	Timegate	Quicksilva	Spectrum	£6.95
▼	21	(9)	Killer Gorilla	MicroPower	BBC	£7.99
▲	22	(29)	Test Match	Computer Rentals	Spectrum	£5.50
▼	23	(16)	Monsters in Hell	Softek	Spectrum	£6.95
▲	24	(—)	Starfire	Virgin	Spectrum	£7.95
▼	25	(18)	The Hobbit	Melbourne	Spectrum	£14.95
▲	26	(—)	Harrier Attack	Martech	Oric	£5.95
▲	27	(—)	Battle of Britain	Microsimulations	Spectrum	£5.50
▲	28	(—)	Matrix	Llamasoft	Vic 20	£8.50
▲	29	(—)	Zoom	Imagine	Spectrum	£5.50
▲	30	(—)	Nightflight	Hewson	Spectrum	£5.50

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PCN Charts

HARDWARE

Top Twenty up to £1,000

	MODEL		PRICE	DISTRIBUTOR
► 1	(1)	Spectrum	£99	(SI)
▲ 2	(3)	BBC B	£399	(AC)
▼ 3	(2)	Dragon 32	£175	(DR)
► 4	(4)	Vic 20	£150	(CO)
► 5	(5)	ZX81	£40	(SI)
▲ 6	(7)	Oric 1	£99	(OR)
▲ 7	(8)	CBM 64	£299	(CO)
▼ 8	(6)	Atari 800	£300	(AT)
▲ 9	(12)	TI99/4a	£150	(TI)
▲ 10	(15)	Colour Genie	£168	(LO)
▲ 11	(16)	Tandy Colour	£240	(TA)
▼ 12	(11)	Atari 400	£150	(AT)
▼ 13	(9)	Newbrain A	£228	(GR)
► 14	(14)	Sharp MZ80A	£549	(SH)
▼ 15	(13)	Apple IIe	£969	(AP)
▼ 16	(10)	Lynx 48	£225	(CA)
▲ 17	(18)	Epson HX20	£472	(EP)
▲ 18	(20)	Aquarius	£99	(MA)
▼ 19	(17)	Sharp PC1500	£169	(SH)
▲ 20	(—)	Microprofessor	£270	(SR)

Top Ten over £1,000

▲ 1	(2)	Sirius 1	£2,525	(ACT)
▼ 2	(1)	IBM PC	£2,392	(IBM)
▲ 3	(4)	Apple III	£2,780	(AP)
▼ 4	(3)	DEC Rainbow	£2,714	(DEC)
▲ 5	(7)	Commodore 8096	£1,374	(CO)
▲ 6	(10)	Televideo TS802	£1,960	(MI)
▼ 7	(5)	Epson QX10	£1,995	(EP)
▲ 8	(9)	Xerox 820	£2,415	(RX)
▲ 9	(—)	Portico Miracle	£1,795	(PO)
▲ 10	(—)	Osborne 1	£1,719	(OS)

AC Acorn Computers. **ACT** — ACT. **AP** — Apple Computer. **AT** — Atari International. **CA** — Camputers. **CGL** — Computer Games Ltd. **CO** — Commodore. **DEC** — Digital. **DR** — Dragon Data. **EP** — Epson. **GR** — Grundy Business. **IBM** — IBM. **JU** — Jupiter Cantab. **LO** — Lowe Electronics. **MA** — Mattel. **MI** — Midlectron. **OR** — Oric. **OS** — Osborne Computers. **PO** — Portico Technology. **RX** — Rank Xerox. **SH** — Sharp. **SI** — Sinclair. **SB** — Sirtel. **TA** — Tandy. **TI** — Texas Instruments.

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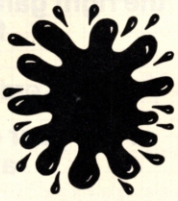

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Foreign bodies in British guise

A letter recently published in your columns suggested that *PCN* should refuse to accept advertisements which did not identify the country of origin of products advertised. This suggestion from J Nixon of Pinner, Middlesex, was obviously inspired by a desire to buy British — or at least to be given the choice — since 'we have enough, nay more than enough, cheap material in Britain already.'

Why should it be necessary to impose restrictions on those whose advertisements support a journal? We all have the choice of asking questions about equipment that we intend to purchase. I recently purchased a stereo radio/cassette player for my car. A well known British manufacturer's name was on the box, the company logo on the front panel and on the loudspeakers. I had 'bought British'. Small stickers on the equipment itself told me that one part had been made in Hong Kong, the other in Taiwan.

Secondly, 'cheap' is relative. Given the choice between otherwise identical items, who can truthfully say that they would pay the higher price?

What choice of home computers would there be if we had no foreign imports? Look inside any computer on the market today and you will find that the vast majority of the components are imported.

If we must suspiciously guard against being sold foreign products in the guise of British goods — so be it. But, at least, let us have the choice of buying what we can afford.

B E Darby
Tonbridge, Kent

Your observation about a micro's country of origin (as it relates to components) is most apt. The silicon chips inside new 'British' machines come from all over the world.—Ed.

Keep it plain and simple, please

Before actually buying a home computer, we accumulated computer magazines at an alarming rate, but we have, however, now decided on a weekly purchase of your magazine.

As newcomers to the computer world, several things seem to be outstanding. Firstly there seems to be a vast amount of games, but while most people obviously like to play these games once in a while, it seems to be a poor use of a sophisticated machine. We most certainly did not buy our computer to zoom and zap across the screen. It might be presumptuous, but my aim is to understand more about computers in general, and in particular I would very much like to learn to do simple programs.

This brings me to complaint number two, although complaint is too strong a word. I cannot find a lot of material to help with programming, in fact, there does not seem to be a lot of practical software.

It was mentioned on a television report to-day that only 4 per cent of computer owners are ladies with children. I do not know why the new hobby does not appeal to ladies more, but it could be because there is very little material which is of interest to women.

My last item is a plea for tolerance. Experts who write on their subject never quite understand that it is not absolutely clear what they have to say. It is, of course, to those who know what it is all about, and it is also as clear as mud to those who don't. Please put explanations in foolproof, simple terms.

Mrs H Mackenzie
Brixham, Devon

You are in luck. Starting in issue 30 we will begin an eight-week simple, fool-proof programming course in our Micropaedia section that will take you from the very basic concepts behind programming to the more complex nuances behind languages, compilers and assemblers—Ed.

Lament on the neglect of the ZX81

The seeming decrease of ZX81 software in micro shops and High Street retailers has prompted me to write this little ditty, reminiscent of the potential Poet Laureats who have graced your pages, in the past:

Down to the shop I merrily went,
A software shop. O, heaven sent!
I went inside to take a PEEK,
And look for things that'd take a week
To order from a mailhouse store
(For you must wait, and that's a bore).
Shelves and shelves there were in store
Of programs, in Basic, m/c, and more.
Lots there were for the BBC,
Spectrum, Oric, and Vic 20.
Tandy, Apple and 64,
All could have bought BYTEs galore.
But I was thinking of myself,
And there was but a little shelf
Of cassettes lined up in a sad, short row.
(It looked to me like an all-time low.)
Now it seems to me that we're being done,
For there's not much new now for the '81
We have, instead, to resort
To magazines of this sort,
And type with care and finger bold
Long-listed programs, new and old,
Or rack our brains and think up some
New program for the '81
So eeeyup! Software houses all,
Rally round to the call.
Or else, if not, one thing's for certain
For the '81 it's the final curtain.

James Cook,
Faversham, Kent.

To keep your '81 replete with software,
Watch our pages for Sinclair programs,
You will find that they are oft there,
And a program on page is worth two in the RAMs
—Ed.

Safety checks on carbonless

I refer to the article 'A Clean Machine' by Barry Miles (*PCN, issue 25*) and in particular to the suggestion that carbonless copy paper may be responsible for respiratory and skin irritation complaints.

Handling *any* paper can cause irritation symptoms to a very small percentage of the population. As a leading manufacturer of carbonless copy paper for conversion to continuous computer stationery our Transcript and Transform products have been regularly and routinely safety tested over a number of years. Results of such independently carried out tests have always shown that these products are no more irritant in normal use than plain paper.

I know that similar results have also been obtained by other well-established major European producers when testing their products at a number of different testing institutes. Many published scientific studies and experiments undertaken by independent workers in occupational health in several countries notably Sweden and Denmark, have obtained similar results.

John R Mitchell,
DRG Paper & Board,
Fife Mills, Glenrothes, Fife

Share your thoughts in the UK's liveliest micro weekly letters columns. Funny, feisty or fanciful, your letter could win you £10 if it's of star status.

WRITE TO: Random Access, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

ROUTINE INQUIRIES

Lost in a maze of bits and bytes, trapped in a forest of errors, or bugged by Basic? Whatever your problem, access our HELP function . . . better known as Max Phillips.

Write to: Max Phillips, Routine Inquiries, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Make your own monitor

Q I am on the lookout for a monitor for an Atari 800 or one of the new XL models, but I also want a new colour TV. Sony produces a system called 'Profeel' where you buy all the components separately. If I buy the tube only, can I use it as a monitor and then buy a tuner later to use it as a TV?
W L Overton,
Harlow, Essex

A Yes, if you want to. The Profeel Tube does have an RGB and a composite video (the one you need for the 800) input. All you would need is the relevant fiddly cable making up.

But the Profeel does seem a bit of a sledgehammer to crack a grape. It is a very nice, very beautiful system. But you could buy any of a large number of modern TV/Monitor sets (try Grundig or Ferguson for starters) and end up with a Teletext set and a lot of change into the bargain.

Joystick choice for Spectrum

Q I have bought a 48K Spectrum with a joystick. I also got the Hobbit, and would like to know how to program the joystick to play the Hobbit with.
Raymond Duguid,
Keith, Banffshire

A Um . . . why would you want to play the Hobbit with a joystick? Surely the point of a joystick is to allow you to use your super-fast reactions to zip around the screen zapping aliens, and as the Hobbit is an adventure game, with on-screen graphics but no on-screen action, it wouldn't help a lot. Unless you fancy frazzling the trolls with the fire button . . .

But seriously, if you don't really have a joystick interfacing problem yet, you probably will soon. Some manufacturers have 'teamed up' so that their games will work with certain joysticks, and vice versa, but that isn't always the case. Other software manufacturers give you details of the POKEs you should make in order to use joysticks, while a third category doesn't bother.

In the latter case you have a choice — either break into the machine code and work it out for yourself, or ring up the manufacturers and hassle them. Guess which is the most fun . . .

But the general advice is, when you're buying a game, check that it will work with your joystick first. When you're buying a joystick, check to see which ones work with the most games.

Just rewards for Genie-us

Q I have written a renumber routine for a 16K Video Genie level II. It is written in Basic and will renumber up to line 64999 with any desired increment. All GOTOs, THENs, GOSUBs and so on are automatically adjusted.

Is there any chance I could market it? How can I obtain a copyright for it?

I'm also completing a program that gives a decompiled dump of the RAM or any machine code program, display of codes and mnemonics for the Z80. Do you think there will be a demand for this sort of program?
M Boota,
HMS Brilliant

A Unfortunately, I don't think you'll find marketing a renumber routine for the Genie very rewarding. It isn't a long, complicated routine, and is probably more suited as a magazine short.

The only possibility would be a really sophisticated version (can yours merge programs, renumber individual sections and so on?) as part of a set of programming utilities. If it's any consolation, provided you didn't steal it from anywhere, you already have copyright on it. But remember, it's a short enough routine for hundreds of users to have written one just like it all of their own.

A Z80 disassembler is a better bet, although still of limited appeal. To beat other offerings, your version would have to offer extraordinary features. It should be able to cope with labels and comments — you should be able to rebuild a complete assembly language source by gradually refining the disassembly as you figure bits of it out.

This may require you to write it all out in assembly language yourself.

Theory of the Oric

Q According to the Oric's manual, the screen memory is not used by Basic unless the GRAB command is used. This doesn't seem to be true. Try this program:

```
10 INPUT C$,A,N%
20 PRINT C$,A,N%
30 GET F$
40 HIRES
50 TEXT
60 PRINT C$,A,N%
```

After the HIRES is used, the string variable is destroyed. How can this be overcome?
Constantinos Georgiodis,
Trondheim, Norway

A This one is so nasty it's hard to believe! When you power up your Oric, Himem is set at 9F00 hex, apparently for no good reason. Rather than being at the top of free memory, it's in the middle of the alternate character set.

So Basic programs which use a lot of data frequently corrupt the character set. The standard fix is to set HIMEM at the more sensible position of 97FF hex at the start of your programs. You'll find that this also stops strings being corrupted when you switch between HIRES and TEXT. You should reset Himem to this location after a RELEASE as well.

RELEASE puts Himem to 9EFF and not 9F00 as you'd expect. There's nothing like a little inconsistency to liven up a machine!

Television trouble

Q I own a ZX Spectrum and I have two problems — both can be annoying. First, if I move my computer even slightly, the plug that goes into the jack socket on the right of the computer seems to get moved. This even happens if I push the plug further in.

Secondly, it seems that if my computer gets hot the screen turns black and white and I have to retune the television.
Barry Hamilton,
London W1

A The best way of working out where the problem lies is to run a few tests.

Some of the older colour TVs (mine for example) take time to 'warm up'. You can tune them so you get colour when you switch on, but you then have to retune them once they've been going a while. Try watching television without your micro for about half an hour, without touching the tuning, and if the picture varies between black and white and colour, this is where your problem lies.

To check the Spectrum, try using another TV. If you get the same problem, it may be that your ULA clock needs adjusting.

You might also find that it is the UHF/VHF modulator or the video circuit that needs adjusting. If you're not used to poking around inside your machine, then the best advice is, *don't*. If it is your micro that's the trouble, then you can only really fix the problem by trial and error adjustments.

As for the jack plug, try sellotape, Blu-tack or any of the other tacky add-ons.

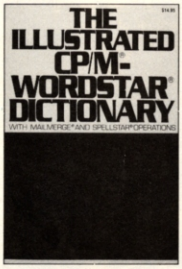
Z81 out for the count

Q I own a ZX81 with a 16K RAM pack. PRINT PEEK 16388 + PEEK 16389*256 should give me the top of RAM. It produces the result 32768. When I divide this by 1024 (1K) I should get 16 as I have 16K RAM. However, to date, I get a result of 32.
Michael Tomlinson,
Wallasey, Merseyside

A I'm afraid you'll never get 32768/1024 to be 16. The point is that locations 16388 and 16389 (RAMTOP) point to the top address in RAM. This is 32768. But a look at a ZX81 memory map will show that the RAM doesn't start at location O. It starts at location 16384.

A little maths. RAM is between 32768 and 16384. So you've got 32768−16384 = 16384 locations. And 16384/1024 is 16.

Which book would your micro want you to buy? *PCN*'s review page helps you choose.



'The Illustrated CP/M Wordstar Dictionary' by Russell A Stultz, published by Prentice-Hall at £12.70 (paperback, 258 pages).

When a program suite as difficult to learn as WordStar-SpellStar-Mailmerge becomes popular it's inevitable that a secondary market in tutorials and manuals will develop.

The Illustrated CP/M-WordStar Dictionary is, however, a poor example of the genre. First, by no stretch of the imagination could it be described as a dictionary — it isn't in alphabetical order, and doesn't supply even one definition.

What it purports to do is to introduce prospective WS-wizards to the features of the CP/M system, WordStar and the associated programs mentioned on the book-cover.

The features are covered in modules, grouping similar concepts together. A reasonable start, but the illustrative doodles (no way do they merit a more dignified name) are pitiful scratchings which bear scant resemblance to what actually appears on-screen.

Examples detailed in the text are competent but dull and don't convey the power locked up in the system, nor do they stimulate the student's imagination.

The end of the book presents a series of test questions, and knowing the answer to them won't make the system any easier to use. For example, the first one is 'What does CP/M stand for?' Who cares? Mr Stultz seems to be more concerned to show how much he knows than with how well his readers have understood the subject.

At £12.75 it isn't worth the money.

RK

'Inside your Computer' by Ian Sinclair, published by Granada at £4.95 (paperback, 114 pages).

Inside your Computer is the latest of a seemingly limitless stream of vaguely micro-computer related titles from the successful Granada Publishers/Ian Sinclair combination.

For once, however, the subject matter is not a particular machine, treated in an identical fashion with similar (if not precisely cloned) listings of unimaginative programs, but the general principles which underline all machines.

This book is intended to give those who are unfamiliar with micros a technical grounding in these little beasts, and the ideas behind the hardware.

Can it? Can any single volume? A point which is not answered by this book.

There's plenty in it, but it is not well-organised and it does not contain any revelations or new material. That, I suppose is hardly surprising — there isn't a lot one can say — but Mr Sinclair doesn't even come up with a new way of saying it.

His explanations of in-CPU bit-twiddling are pedestrian, a trifle confusing and anyway hardly necessary at this level — after all, he's supposed to be introducing computers. He tries to cram an entire University course into 110 pages, and it doesn't fit.

RK

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The Oric apostrophied

The GET function on the Oric works for most keys, but strangely not the apostrophe key. For example, try the program:

```
10 GET A$
20 PRINT ASC(A$)
30 GOTO 10
```

This prints out the correct ASCII code for most keys, but gives an illegal quantity error in line 20 if you press the apostrophe.

It seems that the apostrophe is taken as a null string.

A simple way to avoid this is to PEEK location 53 (35 hex) to retrieve the character. This contains the code for the last key pressed. In the program above, you could use:

```
10 GET A$
20 PRINT PEEK (53)
30 GOTO 10
```

H S Lim,
Moss side, Manchester

Commodore in merger shock?

Among the facilities lacking from Commodore 64 Basic is the ability to merge programs. The short machine code routine given in figure 1 provides this facility.

To use it, LOAD the first part of your program. Add this Basic routine onto it and RUN it. Now type SYS 40448. LOAD the second part of program and type SYS 40468. You should find you have one complete program. Remember to delete the merge routine after you have used it.

You should ensure that the program being merged has higher line numbers than the first program. The routine still works but the program's line numbering will be mixed up if you don't.

M Seeman,
Stockwood, Bristol

```
1000 REM ** MERGE FOR CBM 64
1010 REM POKE 52,159:POKE 56,159
1020 FOR I=40448 TO 40478:READ A : POKE I,A: NEXT
1030 DATA 216,56,173,45,0,233,2,141,43,0,173,46
1040 DATA 0,141,44,0,96,234,234,234,169,1,141,43
1050 DATA 0,169,8,141,44,0,96
```

Figure 1

Colour your Aquarius

The Aquarius guide to home computing does not give any information whatsoever for changing the border, paper or ink colours. I have therefore devised a table of values to be POKED.

When PRINT CHR$(II) is used the border, paper and ink are all reset to normal. In the table, all the numbers should be preceded by POKE *****,

```
 17  RED INK
 33  GREEN INK
 49  YELLOW INK
 65  BLUE INK
 81  VIOLET INK
 97  LIGHT BLUE — GREEN INK
113  WHITE INK
129  LIGHT GREY INK
145  BLUE — GREEN INK
161  MAGENTA INK
177  DARK BLUE INK
193  LIGHT YELLOW INK
209  LIGHT GREEN INK
225  ORANGE INK
241  DARK GREY INK
```

TO CHANGE PAPER ADD PAPER COLOUR −1 + INK COLOUR. To print a white paper and border with blue-green ink use:

```
10 FOR F = 13312 TO 14311
20 POKE F, 7-1 + 143
30 NEXT F
```

Mark Dyos,
Little Sutton, Cheshire

Lynx masters the motor

This short machine code routine allows you to use the cassette motor without pulling the remote jack on a 48K Lynx. The code can be located anywhere in memory, but it's best to reserve memory using RESERVE HIMEM-9 and putting the code at the new value of HIMEM (use PRINT HIMEM).

To load the program, enter CD BD 09 CO CD F2 OC 18 F7 from the monitor and then DPOKE &6225, start address To use the routine in Basic, enter EXT and press return. Press any key to stop the cassette. G6224 will run the routine from the monitor.

T Titchmarsh,
St Ives, Cambs

```
  10 REM horizontal scroll for
  11 REM ZX Spectrum
  12 REM
  13 REM USR 32000 scroll left
  14 REM USR 32017 scroll right
  15 REM
  20 FOR N=32000 TO 32033
  30 READ A: POKE N,A: NEXT N
  40 DATA 33,255,87,14,192,6,32,
183,203
  50 DATA 22,43,16,251,13,32,245
,201
  60 DATA 33,0,64,14,192,6,32,18
3,203
  70 DATA 30,35,16,251,13,32,245
,201
 100 REM
 110 REM demo
 120 REM
 125 PRINT,,,,"ZX Spectrum scro
lling demo"
 130 LET up=0
 140 IF INKEY$="6" AND up>=0 THE
N LET up=up-1
 150 IF INKEY$="7" AND up<=175 T
HEN LET up=up+1
 160 PLOT 255,up: DRAW -16,-up
 170 RANDOMIZE USR 32000: GO TO
140
```

Figure 2

Side by side by Spectrum

This Basic program (figure 2) loads a machine code routine to allow horizontal scrolling on a 48K Spectrum. Once the program has been run, RANDOMIZE USR 32000 to scroll the screen left and RANDOMIZE USR 32017 to scroll to the right.

Lines 100 onwards are a simple demo to show the scrolling working. You can, if you want, save the machine code without the Basic loader with SAVE "SCROLL" CODE 32000,33. Use LOAD "SCROLL" CODE 32000 to get it back again.

John Isaacs,
Bournemouth, Dorset

Dragon on go-slow

Dragon LISTings can be produced at a more sedate pace by using POKE 359,60. This POKE affects everything that is output — try some PRINTs for example. POKE 359,57 is normal speed.

T D Copsey,
Benfleet, Essex

Cross the BORDER problem

The Spectrum's BORDER command causes occasional problems. Try this program:

```
10 PAPER 5 : CLS : BORDER 4
30 PAUSE 0
40 PAPER 3 : CLS : BORDER 2
60 PAUSE 0 : GO TO 10
```

The two-line input area at the bottom of the screen should take the BORDER colour but doesn't. This can, of course, be cured by clearing the screen after executing BORDER. But this wipes out any picture on the screen. A simple fix is to use INPUT INKEY$. This will change the two-line band to match the border. Try it at lines 20 and 50.

Gauden Galea,
Zebbug, Malta

Looks good on paper

If you leave the Sinclair printer permanently attached to the computer, every time you switch on the micro the printer paper advances slightly, wasting inches in the long term.

To stop this, leave the power plug in its socket and turn the computer on from the power switch.

William Hern,
Horner, Kintore

Trevor Jones and the Sinclair Spectrum team up to make beautiful music together.

Sounds interesting — the Spectrum sings

The Spectrum may be the best selling home microcomputer on the market, but when one examines its facilities for making music or sound effects to liven up games, it soon becomes apparent that the machine leaves a lot to be desired.

But you can deal with this limitation by equipping the Spectrum with a sound generator which will allow melodies, chords, and special sound effects to be produced.

The AY-3-8910 is a 40 pin integrated circuit produced by General Instruments. It has three tone generators, a noise generator, an envelope generator, and individual envelope and amplitude control by four-bit digital to analog convertors, as well as two eight-bit ports.

'A sound generator will solve the problem'

The device has a lot of internal registers which are used to select the generators needed to load them with control data. Although it is complicated electronically, it is relatively easy to interface to most micros.

Sound generator

The AY-3-8910 contains 16 internal registers which control the parameters of the sound output, such as attack, decay, tone, noise and volume.

So fairly complex sounds can be synthesised and played quite easily without complex software.

To produce any subtle sounds, you need to understand the registers in the 8910. Figure 1 shows the details of the various registers.

All the registers are eight bits long, but some of them are cascaded (joined) together to allow greater control over the functions to be performed.

Registers one and two are cascaded together to give a 12-bit word which controls the tone period for channel A. The register pair can have any value between one and 4095. The systems clock frequency is divided internally by 16 before it is fed to the tone generator. The output frequency can be easily determined by the following relationship: output frequency equals frequency of the clock/16 times N, where N can be any value from one to 4095.

Registers two, three, four and five are just like registers zero and one, except that they control the tone generators B and C. Control of the noise generator is achieved by using register six, which has its clock frequency divided by 16 just like the tone generators, but only uses five bits of data.

Register seven is the most important register in the sound generator. It is active when its input has a low signal applied to it. By placing 0 in this register all the channels will be enabled, whereas 255 will turn them off.

Bits one and four control tone B and the noise. If bit three is set low with decimal 246, the noise generator will be mixed with tone A.

To set the amplitude of channel A you must set register eight. Only the four lower bits are used — this allows one of 16 volume levels to be obtained. If bit four is set to one, the output level is set by the envelope generator, and hence bits zero to three become redundant and have no effect on the output. To set the volume for channel B and C registers eight and nine are used.

The envelope period is set using registers 11 and 12, which form a 16-bit word. These registers use the clock period divided by 256.

Register 13 determines the cycle and shape of the output waveform. The envelope generator divides the envelope

COMPONENTS

RESISTORS

All resistors are ¼ watt 5%

R1 10M ohms (brown, black, blue)
R2 300 ohms (orange, black, brown)
R3 4.7K ohms (yellow, violet, red)
R4 10 ohms (brown, black, black)
R5 10K ohms (brown, black, orange)
VR1 1K ohm log Potentiometer

CAPACITORS

C1 20 pico farad polystyrene
C2,3,4 4.7 micro farad 15 volt Electrolytic
C5 100 nano farads Polyester (brown, black, yellow, white, red)
C6 10 micro farads Electrolytic 15 volts

SEMI CONDUCTORS

IC1 4011B
IC2 4013B
IC3 74LS04
IC4 74LS02
IC5 74LS08
IC6 AY-3-8910
IC7 LM386

MISCELLANEOUS

Veroboard 5 × 3¾ inches 0.1
5 × 14 pin integrated circuit sockets
1 × 8 pin integrated circuit sockets
1 × 40 pin integrated circuit sockets
1 pack of Veropins
Connecting wire
Spectrum edge connector
4 Megahertz crystal
Connecting wire
Solder
8 ohm 1 watt loudspeaker
1 small toggle switch

FIGURE 1 — DETAILS OF THE EIGHT BIT REGISTERS

REGISTER	FUNCTION	BIT 7	6	5	4	3	2	1	0
R0	CHANNEL A TONE PERIOD	8 BIT FINE TUNE A							
R1						4 BIT COARSE TUNE A			
R2	CHANNEL B TONE PERIOD	8 BIT FINE TUNE B							
R3						4 BIT COARSE TUNE B			
R4	CHANNEL C TONE PERIOD	8 BIT FINE TUNE C							
R5						4 BIT COARSE TUNE C			
R6	NOISE PERIOD				5 BIT PERIOD CONTROL				
R7	ENABLE	IN/OUT		NOISE			TONE		
			A	C	B	A	C	B	A
R8	CHANNEL A AMPLITUDE				ENV	4 BIT AMPLITUDE			
R9	CHANNEL B AMPLITUDE				ENV	4 BIT AMPLITUDE			
R10	CHANNEL C AMPLITUDE				ENV	4 BIT AMPLITUDE			
R11	ENVELOPE PERIOD	8 BIT FINE TUNE							
R12		8 BIT COARSE TUNE							
R13	ENVELOPE SHAPE					4 BIT CONTROL			
R14	I/O PORT	8 BIT PARALLEL PORT							

period by 16 to provide the 16 states per cycle envelope pattern as selected by bits zero to three. The patterns obtained are shown in figure 2 along with the decimal values used to produce them.

The output ports that can be used with joysticks and interface circuits are controlled by registers 14 and 15.

The circuit

The circuitry employed is relatively simple and falls into four main groups.

- Clock frequency generation
- Decoding logic to address PSG
- Sound generator
- Amplification of output signal

The clock frequency is derived from a 4MHz crystal which is divided by two by IC2 and applied to the 8910.

The decoding is carried out by the logic circuitry contained in IC three, four and five. What this does is to select the 8910 chip when an OUT command that contains the right address is placed on the computer's bus.

The sound generator is IC six, and this produces all the tones and noises required, depending on the setting of the internal registers. The sound produced is further amplified by the old work-horse LM386 low power audio amplifier, which is coupled to a miniature 8ohm half watt loudspeaker.

Construction

The circuitry is not difficult to build, but care should be taken, as there are lots of tracks to cut and wire links on the veroboard. Printed circuit board could have been used instead, but this would obviously increase the cost.

Refer to figure 3 and make all the necessary track cuts. Insert the wire links followed by the integrated circuit sockets. The resistors, capacitors and the crystal can then be placed onto the board. Veropins are then inserted, and any further links can be soldered in place on the board.

Wire up the loudspeaker and volume control VR1 as on the diagram, and insert the integrated circuits into the sockets. The whole unit is now ready to be placed inside the case. The speaker is attached to the fret cloth with any general purpose adhesive, such as Araldite. The case should have a slot cut into it to allow the edge connector 20 ▶

FIGURE 4 — LAYOUT DIAGRAM OF SOUND GENERATOR

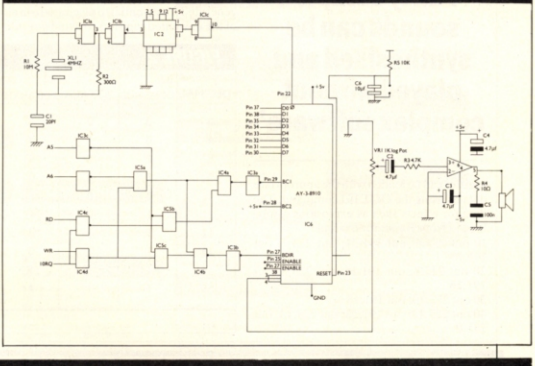
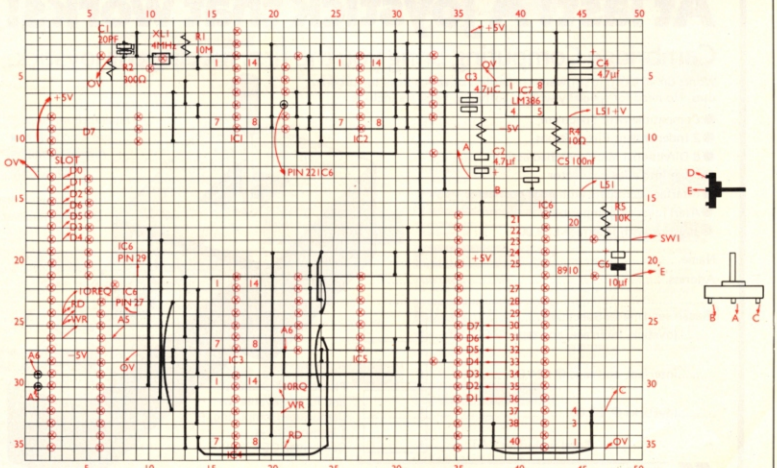


FIGURE 3 — CIRCUIT DIAGRAM OF SOUND GENERATOR



◄ 19

to protrude out so that it can be plugged into the back of the Spectrum.

To get any sort of noise out of the sound generator you have to get the Spectrum to put the correct signals onto the data lines. This is accomplished by using the OUT command, eg out 223, RN to select register n.

After this has been done, the selected register can be loaded with the appropriate data by using the OUT 191 command. The data for effects such as explosions can be loaded from Basic, for example:

10 out 223,6: out 191,31: out 223,7: out 191,7
20 out 223,8: out 191,16: out 223,9: out 191,16
30 out 223,10: out 191,16
40 out 223,12: out 191,20: out 223,13: out 191,0

'Fairly complex sounds can be synthesised and played without complex software'

Line 10 sets up the noise generator and enables all noise outputs. Line 20 configures the level of channel A and B, whereas line 30 controls Channel C level.

The rest of the data controls the length of the delay and sets up the envelope generator so that the waveform of the sound decays. This small piece of code could be stored as a subroutine and called by the main program when required.

All the registers will retain their previous value if they are not reset after use, therefore if more than one effect is to be generated it is essential to place a zero in all of the unwanted registers to avoid any odd

'It is relatively easy to interface to most micros'

be adopted.

effects being generated. Obviously random values could be placed into the registers to see what type of effects they give, or a more systematic approach could be adopted.

FIGURE 2

DECIMAL	B3 CONTINUE	B2 ATTACK	B1 ALTERNATE	B0 HOLD	GRAPHICAL REPRESENTATION OF THE ENVELOPE GENERATORS
0	0	0	X	X	
4	0	1	X	X	
8	0	1	0	0	
9	1	0	0	1	
10	1	0	1	0	
11	1	0	1	1	
12	1	1	0	0	
13	1	1	0	1	
14	1	1	1	0	
15	1	1	1	1	

→ ←DURATION OF ONE CYCLE

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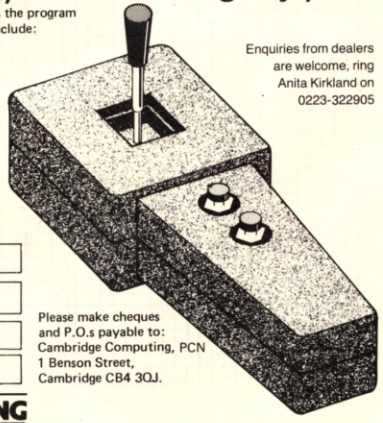

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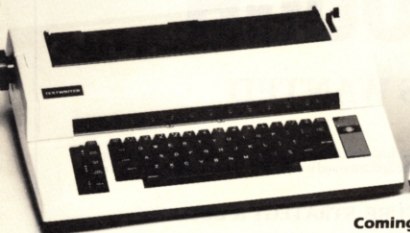

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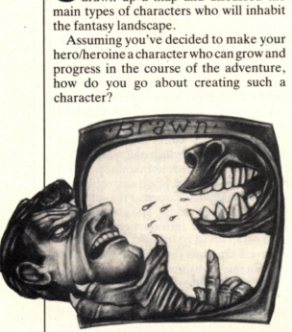
Character creation and pitfalls are John Noad's concern in the final part of this programming series.

Creative characters

So far in this series we've roughed out the plot of your adventure game, drawn up a map and discussed the main types of characters who will inhabit the fantasy landscape.

Assuming you've decided to make your hero/heroine a character who can grow and progress in the course of the adventure, how do you go about creating such a character?



In practical terms we can either give the player a fixed number of 'character points' to distribute between, say, six characteristics in any way that they wish (within certain upper and lower limits), or we can have the computer do the same job, in a fairly arbitrary manner, by using a random number generator.

(There is actually another alternative where the player selects his or her character type from a given list. However, since the writer will have assigned a fixed set of characteristics to each type this is really a limited variation of the first option.)

Whichever option you adopt the main point is that the player starts out with a set of characteristics, each of which may grow or shrink as he goes along — and make a great deal of difference to the outcome of the game.

Given this situation, the game must include at least one *unavoidable* situation to test each characteristic.

A typical set of characteristics might include strength, dexterity, intelligence, wealth, luck and size.

A character's size isn't likely to change, unless he gets his head or legs chopped off (or finds a magic potion), but it can be used to decide whether he can follow certain paths, cross certain obstacles, or hide in a tricky situation. All the other characteristics may well be affected by what happens during a game, however.

Let's take strength as an example. Characters with a low strength rating are clearly going to be hampered in several ways. There will, for instance, be a limit on the size of the weapons and equipment that they can handle effectively — even if they have a high dexterity rating.

Such characters will need to rely on their intelligence and luck rather than brute force wherever possible. And if they do run into a fight or some other test of strength they will need to win through or escape as quickly as possible, since a zero strength rating equals 'You're dead'.

Having said that, you might also like to raise a character's stength rating by an appropriate amount if they overcome an especially difficult physical test.

Apart from conflict and test situations, one of the most critical uses of the test characteristic is that it should govern what a character can carry.

Those of you who already have some experience of adventuring will no doubt be familiar with the INVENTORY function under one name or another. Basically it controls, records and lists on request the items that the player is carrying at any given moment. Unfortunately, many adventure writers in the past have used the number of items carried as a way of limiting the size of the inventory. This can lead to the sort of ridiculous situation where the player can pick up a sledgehammer (one item) but has to drop something in order to pick up a box of matches and an oil lamp (two items) because the player is already carrying five items and may not carry more than six items at a time.

Since you will need to include an inventory size routine in your program anyway, rather than use numbers of items as the limiter, why not assign a weight to each portable item and calculate the permissible inventory as a percentage of the player's strength rating?

A word of warning. If you do decide to use this method, don't leave too many small objects lying around, or stronger characters could end up with an inventory list that takes up the whole screen.

Of the other characteristics, dexterity, intelligence and wealth are self-explanatory.

And that leaves luck. Doesn't that run against my previous argument that a game should be evenly balanced?

Actually it doesn't. In the first place luck, or what looks like luck, plays an important part in real life. Luck can be both good and bad. Second, the element of chance, used in moderation, adds spice to a game.

Will the hero notice a small trap door in a dark corner that leads to a short cut or out of trouble? Will he be killed, wounded or escape unharmed from a cunning booby-trap? Will a small or poorly armed character strike a lucky blow and defeat a superior attacker? The luck factor can work to maintain the balance of a game, so don't be in too much of a hurry to cross it off the list of useful characteristics.

Interior decor

Back to the maps. We need to decide what should, and should not, go into all those rooms. Now we come to a part of the process that is not only important but often also the most difficult to get right — the 'interior decoration'.

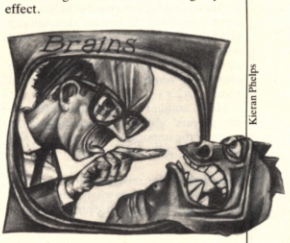
Filling the rooms to the best possible effect is largely dependent on the inventiveness of the writer. The best games are usually those which offer the most original problems for the player to overcome. The only coverall rule that comes to mind is that the filling of the rooms should be directly related to the characters who inhabit the fantasy world.

Rather than making specific recommendations, we'll concentrate on the main areas where mistakes are made, even by professional writers, and to suggest some of the ways in which they can be avoided.

Overcrowding There's always a temptation, especially when you're working with a limited number of rooms, to try to fill every nook and cranny with people, creatures and objects. Resist this temptation. No writer wants to waste space, but this is one of those situations where too much can be as bad as, or worse than, too little — for several reasons.

First there's the element of surprise.

Let's suppose you decide to put two things in every room, be they people, creatures or objects. What you have done is to give a pattern to your game, and even the dumbest player will soon realise that there are going to be a couple of things to deal with in each room. So how do you hide anything? How do you create an element of surprise? Obviously you'll now have to put three things in some rooms to get your effect.



Kieran Phelps

At that rate even a quite small adventure would soon start to look like a tube train in the rush hour. And you still won't really have the advantages of surprising the players, as they'll soon learn to be on the look-out for extra items. The second objection to overcrowding takes us back to

24▶

the reason why it usually occurs — limited RAM space. For while you have space by having a small number of rooms to describe, if the rooms are overcrowded you'll need the extra space to cope with larger item arrays, and for the extra subroutines that process the added events.

Generally speaking, it is better to keep the number of things in an adventure down to a minimum and to spread them out in what would appear to be a random manner.

The unsettling effect of the occasional empty room can be heightened by having at least a couple of things which are randomly placed by the computer itself at the start of each game. In this way a cartain room might come up empty for several games in a row, and then suddenly become inhabited by an aggressive monster in the next. (This is also one way of catching people who try to LIST a game before playing it.)

Moral number 1: Go for quality rather than quantity. Most players will gain more satisfaction from overcoming one really challenging problem than they will from resolving half-a-dozen problems that look petty and pointless once the solutions are known.

Being obvious Watch out for the thin line that divides being fair from being over obvious. Being fair means writing an adventure that follows a consistent set of rules and setting problems that anyone with a reasonable amount of intelligence and general knowledge should be able to solve.

Being obvious means . . . well let me tell you a game I came across a few months ago.

In this game the only solution to the problem that provided the climax of the game was to drop a banana skin. This skin was placed at the start of the game in a room about halfway through the maze and, in that position, seemed to serve no useful purpose.

Unfortunately the writer ruined a rather clever and amusing piece of problem-setting by making it impossible to leave any room containing the banana skin without picking it up. Thus there was no need whatever for the players to recognise the significance of this item since they had to be carrying it when they came to the final room.

Moral number 2: Don't underestimate the players' ability by telegraphing the value of the important clues, objects, and so on.

Being devious One mistake that occurs even more frequently arises when writers try to be too subtle. Take an example from a professionally written game.

'Use booby-traps harshly if you will — but be fair'

The writers chose to provide the player with an extra (and very necessary) piece of equipment. They claim that their game is fair, but the way this item is introduced makes no sense. It is, therefore, anything but fair.

The scenario is like this. In room X you are allowed to GET one or more of three listed items, none of which has any immediate value. If you use the INVENTORY command before leaving room X you will only be told which, if any, of the three listed items you are carrying.

You now proceed to room X+1 (room X has only one exit) and find yourself with a problem to solve. If you use any command other than INVENTORY you will be killed immediately. However, if you do call up the inventory again — though there is

no earthly reason why you should — you will find that somehow or other you have acquired an extra piece of equipment which you can use to avoid being killed!

It may well be that the writers of this game have some explanation for the incident, but I suspect that they alone know what it is.

Moral number 3: Be logical. There's no reason why you shouldn't introduce odd events into a game if you wish, so long as the player has a genuine chance of finding out what's going on and how he can deal with it.

Think player There is a rather different but no less frustrating fault: that of overlooking the player's point of view.

There is, in one very well-known and popular game, a point at which the player must conceal himself in a certain object in order to be able to move on to the next part of the adventure.

As it happens, the object concerned is only one of several similar objects, though the player cannot specify which one he will hide in. Instead, if he makes the right choice (*ie* to hide) quickly enough then he will, by default, hide in the right object. If he takes too long over his decision he will be told that he cannot hide at all — even though a hiding place is available.

Clearly this is an illogical situation, the mark of careless programming. If the program had been capable of dealing with just one more item — the fact that the correct hiding place was no longer available — then the other potential hiding places could have been sealed off and the whole situation would have been made consistent without giving the player an advantage.

Moral number 3: Think player. If the only acceptable way to break a window, say, is with a stone then make sure that the player has no other implements on hand capable of doing the job. Take time over the problems you set and, if there are alternative solutions either block them off or expand the program to deal with them. Don't just hope that they will go unnoticed.

Booby-traps: These can be used or abused. In another game written by an amateur, it was possible to find the final problem in the game in only eight moves. Moreover one could solve this problem — a combination lock — simply by trying all the different possible combinations.

Obviously this would have ruined the rest of the game, in which one searched for clues to the correct set of numbers, but it was possible. Indeed, given an overdose of luck one might have opened the safe after only five or six attempts. The answer to this situation was the introduction of a fatal booby-trap set to go off after two or three incorrect attempts (making allowance for the odd mis-hit by the player).

Basically there are two types of booby-trap: those which can be made safe (defused), to penalise unwise players (for being too rash or too greedy), to prevent the player from short-cutting (as above), or as a means of creating a little confusion by protecting a red herring — an object or clue which is not essential to the game. But remember, if you're only trying to prevent short-cutting make sure that there is also a legal way round the booby-trap.

Defusable booby-traps are legitimate problems in their own right, of course, and finding devious solutions to tortuous situations can be as much fun for the writer as it will be for the players.

Moral number 4: Use booby-traps harshly if you will — but be fair. There is an allegedly true story that, some years ago, the writer of a cartoon strip adventure story was given the sack and his job handed to another author. Not being exactly thrilled by this the first writer, bound by contract not to kill his main character, settled for leaving the hero chained to a large rock at the bottom of the sea, with no air supply and facing a giant killer shark. The incoming author took one look at the comic strip and then wrote a nine word caption to start the next day's strip. It said: 'With a leap and a bound he was free!'

This kind of thing may work in comic strips, but it's the opposite of good adventure game writing.

On last tip: a lot of clues on how to avoid bad adventure writing can be gained from reading reviews of games already on the market. Although a lot of these games are already available commercially this is still a very young art form. So don't miss the chance to learn from other people's mistakes.

In a future series we'll be looking at some of the problems involved in writing the actual program for an adventure game.

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Bernard Wragge-Morley reaches a new Zenith — the Z-100, a strong business contender.

Quality at a price

The Z-100 is produced by Zenith Data Systems. Although it is not well known in this country, it is owned by the American Zenith Radio Corporation which has been trading for about 60 years.

About five years ago it decided to change gear and enter the computer race which it managed to do by buying Heath Electronics, of Heathkit fame, from Schlumberger. At that time Heathkit was marketing a computer kit which, in its assembled form, became the Z-89, and later the Z-90. These instantly marketable products gave Zenith the time to begin the development of the Z-100 range of computers.

The first of the range, the ZF-110-22, a low profile twin floppy disk version, was released in April 1982, and now the ZW-110-32, fitted with a Winchester disk, has been released.

Zenith, having been in the television business, produced its own VDU, the ZVM-134E, which was to all intents and purposes a modified television. It has now managed to better this with the new ZVM-135E, of which more later, which will replace the 134 in about November of this year. *PCN* was able to review the only one in this country to complete the system.

Presentation

The system arrived in three sturdy cardboard boxes filled with good, purpose-made packing, which should enable it to withstand the rigours of almost any means of transport.

The review machine was a low profile Z-100 which includes the processor and two disk drives, in this case a 5in 11Mb Winchester and 5¼in 320K floppy, and a 14in colour monitor.

Documentation

Having opened the first two boxes which contained the Z-100 and VDU I began to wonder what would be in the third. Could it be a printer? It weighed enough. Actually, it was full of manuals! This really was a sight for sore eyes.

They came in looseleaf form with two folders for each software package, and divider cards for the different subjects to give faster access to the relevant section. Also with the manuals come the sealed envelopes containing the disks.

Taking stock I found I had:

1 Z-100 User Manual with Winchester Supplement

2 Z-DOS Operating System Manuals with Winchester Supplement

2 CP/M-85 Operating system manuals

2 Z-Basic Manuals + quick reference guide.

The obvious manual to start with was the Z-100 Users Manual with the customer demonstration disk. The main part of the manual takes you through every keypress of getting started and making the usual security copies of the disk. Unfortunately, the explanation of how to run the demo package, although basically sound, fails due to a bug in the program 'CHOICE', which is a shame as in all other respects I was unable to fault the manuals or the software provided with the machine.

With all the manuals Zenith has taken the originals produced by Microsoft or Digital Research and performed extensive editing, and in places has completely rewritten some of the explanations.

The printing is of high quality and good use is made of different styles of type to show clearly what would appear on the screen and what should be typed in on the keyboard. There are a number of appendices to each manual which give quick references for commands, or contain data about the machine itself.

The Z-Basic manual has its own pocket-sized reference guide which gives a brief description and short examples of all the commands.

The first-time user may well find this wealth of information rather daunting, but as long as you start with the Users Manual and work in Basic, the other manuals will become valuable reference material as you gain experience in programming.

'The display can be considered high resolution'

Construction

The main unit is constructed in ABS foam of a light creamy brown with a brown front panel. The top cover is easily removed by means of two quick-release catches from the back. The front panel can then be lifted out of its slots, revealing the two disk drives held in their own plastic subframe and secured by four screws.

Once removed, the motherboard is revealed, in which all the chips are socketed, and the dual processors, 8088 and 8085, can be seen. There are no circuit diagrams supplied with the unit, but a quick look round the board reveals the ROM, RAM, video RAM etc.

At the back are the five S-100 expansion slots with the card cage mounted vertically up from the motherboard. Along the very back edge of the board are the three I/O port connectors, all 'D' types, mounted and screwed into both the board and back panel making them safe from abuse.

The power supply takes up the whole left-hand edge of the machine, and is fan cooled. The fan itself is unbelievably noisy, and quite unnecessarily so. The exhausted air is blown out of either side of the power supply, across the S-100 slots and out of the vents in the side of the case. This is convenient from the operator's point of view as you don't get a howling gale hitting you between the eyes. There is also no filter fitted to the fan, so the power supply will probably fill with dust in the average office environment.

Keyboard

The Zenith has an integral qwerty keyboard that is sculptured and easy to use. Above the standard qwerty layout are 13 function keys which produce fixed 'escape' codes, listed in one of the appendices. There are also two keys on this row for insert and, when shifted, delete, character and line.

To the right of the qwerty block is a calculator pad which also includes the cursor keys and an 'Enter' key which has the same effect as carriage return for most purposes.

All the keys are self repeating when held down for about one second, and can be made to fast-repeat very simply at the push of another key, which is very handy for underscoring and the like.

There is also a reset key with a light in the top which appears to indicate power on. A reset is only performed if this key is pressed in conjunction with the control key, so you are safe from accidentally wiping out all your hard work.

Screen

The VDU supplied with the system was Zenith's new Z-135 14in colour monitor, which will accept either RGB or composite video input, selected by a slide switch on the recessed back panel. The other switch on the back selects either full colour or green on black, which is easy on the eye when doing a lot of text processing.

There are also two sockets on the back panel; a 'phono' for composite video or a 25-way 'D' type for both RGB or composite input.

The front panel boasts a volume control, an on/off switch and a section which flaps down to reveal soft focus, tint, black level (constast) and an audio output socket.

Powering up the graphics demo package revealed sharp square pixels with good colour saturation, and a few simple commands in Basic produced white over the whole screen with very little fringing or tinting. For the personal computer market this display can be considered high resolution, and it represents good value for money. It is unusual to find a VDU in this market which produces not only clean

30▶

Top: The Zenith Z-100 is available as this 'low profile' version or as a single intergrated unit incorporating a built in monochrome monitor. Left: The Z-100 uses standard MS-DOS format 320K floppies with an optional 11Mb Winchester. Right: Copious documentation — seven manuals and a reference guide.

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graphics but also good readable text. The line separation in text mode was large enough to stop the lower case decenders interfering with the capitals on the line below.

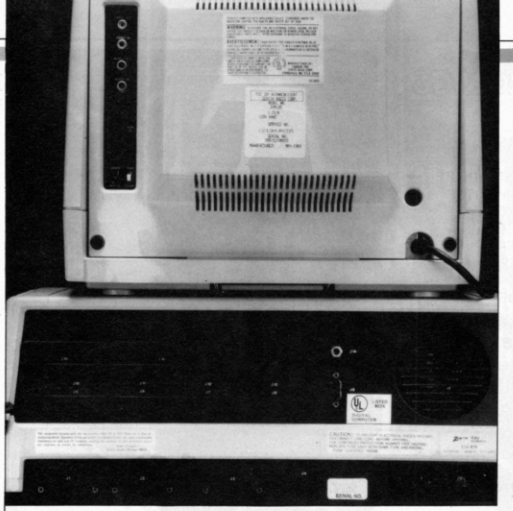
The review monitor was the only one of its type in the UK and had done a fair bit of travelling. As a result there was a slight curve in the top right-hand corner and a raggedness to the left edge which I would not expect from the unit when correctly set up, but my main criticism is that the screen would benefit greatly from being etched to cut down the glare.

If you already have a monitor there are a number or switches in the Z-100 which would enable you to tailor the video output to suit most common displays.

Right: Round the rear of the machine is its noisy fan and removable panels to allow further S100 interfaces to be fitted. Two RS232 and a Centronics interface are fitted as standard. The serial interface is extremely versatile, giving the user control of a variety of options.

Above: Inside the Zenith are its two drives (front right), hefty power supply (left) and S100 bus (back right). Two of its five S100 slots are already occupied with the disk drive controllers. The computer's main board is underneath the disk drives.

Below: The Zenith has a complete sculptured keyboard with 12 function keys, a numeric keypad and cursor keys.



Storage

The review system had an 11Mb 5in Winchester disk and a 320K 5¼in floppy. The sheer speed and size of a Winchester makes using a micro for integrated accounts really worthwhile for small and some medium sized businesses. The response to loading in a 24K package like Z-Basic appears near instantaneous to the operator, and with programs like Wordstar you would no longer have to wait for disk transfer. As 192K of RAM is standard in the Winchester version there is quite a bit of operating space anyway.

If you can't afford the Winchester there is a dual floppy version available, and if you are upgrading from the old Z-89 system you can connect up your old 8in floppies and download your old programs.

The Winchester disk can be partitioned to appear like a number of different disk drives so you could change from Z-DOS to CP/M by changing disk partition, or you could use different sections of the disk for word processing or accounts.

Zenith has plans to increase the floppy drive capacity by going from a 48 tpi drive to 96 tpi so that it will not be necessary to have so many floppies to back up the whole Winchester, and these days the 96 tpi floppies by reputable makers are pretty reliable.

Expansion

Zenith has gone for the tried and tested S100 bus expansion slots, for which an enormous range of plug-in boards are available. Two of the slots were already filled on the review machine, one with the floppies by reputable makers are pretty reliable.

There are three I/O ports on the back panel — one 8-bit parallel printer interface (Centronics type), one serial printer port (RS232C) and one serial modem port.

All the ports are configurable using software selection with a couple of DIL switches to change the Centronics port to cope with your particular printer's idiosyncrasies.

The serial interface is one of the most versatile I have seen in a menu-driven configuration. Not only can you change the usual speed, parity, stop bits, word length and so on, but you can even choose which polarity of handshake you require.

Software

Two operating systems are supplied with the machine: Z-DOS, which is Microsoft MS-DOS under another name, and CP/M from Digital Research. Two volumes of manuals come with each operating system, giving detailed instructions of all the available commands. Microsoft Basic is also supplied, again with two volumes of manual, and runs under Z-DOS. This gives access to all the full-colour graphics facilities.

The operating systems are supplied on two 5¼in floppy disks, one with the assembled programs and one with the source code, so you can modify to your own needs if you feel you are competent to do so. It also allows you to interface your own programs or hardware through the S100 bus with the operating system.

In Basic, full on screen editing is available using the cursor keys, and with the insert/delete functions quick changes to the text could be performed with the minimum of effort.

The only application software supplied was in the form of an Integrated Business Graphics package which was on the customer demonstration disk. This is where I come to the error mentioned earlier with the program CHOICE. The manual says that to run the demo package type: "Z BASIC CHOICE". This performs as would be expected, Z Basic loads, then CHOICE loads. The program asks you to press F1 or F2 to select either of the demonstration packages, but unfortunately selecting either simply returns you to the Z-DOS prompt "A:". You can get round this by ignoring the program choice and typing "Z BASIC F" for the artwork display, or by typing "Z BASIC MENU" which selects the business graphics demonstration.

The alternative way to run the package is using AUTOEXEC.BAT, but once used the disk will always boot into this program on power-on.

Support

The Z-100 comes with only a 90-day warranty, which is rather short, other manufacturers offering one or two years. Service is provided throughout the whole of the UK by Mills Associates, specialists at servicing and repairing computers from mainframes down to micros.

Verdict

This is not a new system but a tried and tested machine, which now has the added benefits of an 11Mb Winchester disk and a much improved colour monitor. It is nonetheless made with very current technology, dual processors (one 8 and one 16-bit), and plenty of memory. It is too old to be IBM PC compatible, but uses the same operating system so at least some of the software should be transferable.

This is undoubtedly an 'office personal computer' and, as such, is good value.

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Ted Ball logs onto Snail Logo for the Spectrum, but finds his turtle's still in the soup.

Snail trail

Logo is a programming language, basically a dialect of Lisp, which was developed at Massachussetts Institute of Technology for use in education. The feature of Logo that has received most attention, and which makes Logo particularly suitable for younger children, is Turtle Graphics, which makes it easy to draw pictures on the screen or to control a robot turtle.

Snail Logo provides a version of turtle graphics, but not the full Logo language, for the 48K ZX Spectrum.

Features

Turtle graphics is based on the commands FORWARD and BACKWARD, which draw a straight line of a specified length, and LEFT and RIGHT, which turn the direction of the line a specified number of degrees. By combining these commands you can draw any kind of picture, but for easy and efficient use of the turtle graphics commands you need the full support of a properly designed programming language.

MIT Logo is a complete structured programming language that allows you to use meaningful variable names, a full range of arithmetic, logical and conditional expressions, functions and procedures with local variables, and recursion. Snail Logo, however, is cut down so much that all the features that make MIT Logo easy to use have been eliminated.

Snail Logo has the basic turtle graphics commands, FORWARD, BACKWARD, LEFT, RIGHT, DOWN and UP (PENDOWN and PENUP in MIT Logo), which make the subsequent track visible or invisible, and a few additional graphics commands like POSITION, which moves the snail to an absolute position on the screen, and COLOUR, which sets the colour of the snail track.

The instruction booklet claims that 'Snail Logo has a language and operating system which provides an advanced version of Turtle Graphics,' and 'Snail Logo language is very high level,' but it is very limited in its commands and syntax. Apart from the actual turtle graphics commands it is just about on the level of assembly language, and in some areas provides fewer facilities.

Variable names are limited to the letters A to H, and D has a fixed meaning — the current direction the snail is pointing. To give a value to a variable you use the command SET V,n where V is the variable name and n is a number. For arithmetic the commands are DECREASE V,n to subtract a number from a variable, INCREASE V,n to add a number to a variable, and MAKE V = *expression* where *expression* may be V+V, V−V, V*V or V/V (the Vs don't have to be the same each time).

To define loops in Snail Logo you have REPEAT to mark the beginning and RFINISH to mark the end of the loop. Loops may be nested to any level subject to the maximum size allowed for a program or procedure.

The commands FORWARD, BACKWARD, LEFT, RIGHT and REPEAT must be followed by a parameter, which may be a variable or a number. If your program requires an expression for the parameter it has to be calculated beforehand and assigned to a variable.

The only conditional statements allowed in Snail Logo have the form, IFEND *condition*, where *condition* may be one of V=V, V>V, V<V. The IFEND statement terminates a procedure if the condition is true. This is the most obvious area where Snail Logo is inferior to assembly language.

You are allowed to define named procedures that can be called from the main program or another procedure, or which can call themselves recursively. The variables A, B, C, and D are local to the procedures, with new copies of them being made each time a procedure is called. You can pass values of A,B and C to a procedure by giving one, two, or three numbers in the procedure call to assign new values to these local variables, or when the numbers are not given in the procedure call the current values of A, B, and C are passed on.

There is a bug in the way the parameters are passed to recursive procedures. An example from the instruction booklet is:

```
Procedure JOE
FORWARD A
INCREASE A,1
PROCEDURE JOE,1
END
Program
PROCEDURE JOE,1
END
```

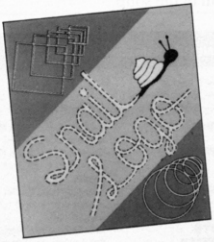
What happens when the program is run is that the snail moves forward one step when the program calls the procedure JOE

SNAIL LOGO Instruction Summary

n — A number
V — A Variable name A to H
N — A number or a Variable name A to H

FORWARD N	— Moves the specified number of steps in the current direction.
BACKWARD N	— Moves the specified number of steps opposite to the current direction.
RIGHT N	— Rotates the current direction clockwise by the specified number of degrees.
LEFT N	— As for RIGHT but anticlockwise.
REPEAT N	— Causes all instructions following it to be repeated the specified number of times.
RFINISH	— Terminates the effect of REPEAT.
POSITION n,n	— Sets the current position of the Snail to the values given (Horizontal, Vertical).
COLOUR n	— Sets the colour of the Snail track.
SET V,n	— Sets the Variable to the value given.
DECREASE V,n	— Subtracts the value given from the Variable value.
INCREASE V,n	— Adds the value given to the Variable value.
SHOW V	— Prints the Variable value and name on the screen.
MAKE V=V+V	— Adds variables.
MAKE V=V−V	— Subtracts Variables.
MAKE V=V*V	— Multiplies Variables (Note "star" as in Basic).
MAKE V=V/V	— Divides Variables.
IF END V=V	— Ends the program or procedure if the condition is satisfied.
IF END V<V	— Ends the program or procedure if the condition is satisfied.
IF END V>V	— End the program or procedure if the condition is satisfied.
SNAIL	— Causes a Snail symbol to be displayed at the end of each track produced by the following instructions.
NSNAIL	— Cancels the effects of SNAIL.
DOWN	— Causes Snail tracks (and symbol) generated after this instruction to be visible.
UP	— Causes Snail tracks (and symbol) generated after this instruction to be invisible.
OUTPUT	— Causes an element of Snail track to be printed at the current position.
CENTRE	— Moves the current position to the screen centre.
NORTH	— Sets the current direction towards the top of the screen.
RNORTH	— Sets the current direction to the initial direction when the program or procedure started.
CLEAR	— Clears the screen.
END	— Must be used as the last instruction in programs and procedures.

Instruction	*Range for n and N*
FORWARD, BACKWARD	Whole number 0 to 999
REPEAT, SET INCREASE, DECREASE	
RIGHT, LEFT	Whole number 0 to 999 and the value of 22.5
PROCEDURE	1 to 62 for horizontal
POSITION	1 to 42 for vertical
COLOUR	0 to 6



◀ 33 (the 1 in the procedure call sets the value of A). The snail moves forward one step again the first time JOE calls itself. So far this is what you would expect, with the value of A being set to 1 each time JOE is called, but after this each successive call moves the snail two steps, three steps, etc.

The booklet does not call this a bug, but tries to explain it away as being necessary for recursion, which is just not true. This is the first time I have seen anyone seriously trying to get away with implementing the traditional programmers' joke that documenting a bug turns it into a feature!

Presentation

Snail Logo comes in a cardboard box which contains the cassette and instruction booklet. The cassette is clearly labelled and has a copy of the language on each side. The instruction booklet is neatly printed and includes a tutorial section as well as sections describing the commands, operating system and error messages. An appendix, printed on a separate sheet, gives instructions for using it with Colne Robotics' Zeaker Micro-turtle (reviewed in *PCN issue 21*).

Getting started

The instruction booklet explains the language step by step, beginning with an explanation of turtle graphics and how to run the example program provided on the tape, and proceeding through the use of the menu to list, enter and edit programs. This tutorial section includes a number of fully explained example programs for you to type in while you are learning to use Snail Logo.

In use

The first thing you notice is how slow it is. The demonstration program on the tape, which shows a flower growing, takes about 1 minute and 20 seconds to run, and even something very simple — drawing a square of ten units a side — takes 15 seconds. Using the editor to make changes to a program is also very slow. You first have to wait for the program to be listed on the screen, at the rate of about five seconds per line, and after you have made your changes you have to wait for the program to be listed again before you can do anything else.

It's menu driven, with one menu for the main operating system and subsidiary menus for using Zeaker, entering programs and procedures and using the editor. Although the menus save you having to remember all the operating system commands, they make it rather tedious to use.

When you come to write programs in Snail Logo it is easy to produce simple geometric shapes like triangles and squares, and to put these together to make more complicated drawings but beyond this the limited syntax makes things very difficult. For example, even something as simple as setting one variable equal to another has to be done in a roundabout way. To set A equal to B you would have to do something like:

```
SET E,1
MAKE A=B*E
```

Although it is possible to write equivalents of IF . . . THEN . . . and IF . . . THEN . . . ELSE . . . in Snail Logo it is difficult and the resulting code is almost impossible to follow. It is just like trying to write programs in a cut-down Basic, where the only conditional statements you could use were RETURN IF expressions!

You can list programs and procedures and copy the screen display onto the ZX Printer. But it doesn't provide any way of saving programs on tape, so if you want to use a program again you have to retype it from scratch.

Reliability

Apart from the problem with local variables in recursive procedures, it is fairly reliable. It will not allow you to enter invalid commands and gives informative error messages for both input errors and such run time errors as division by zero and stack overflow.

It is possible to get back into Basic in some situations by pressing Break, and the instruction booklet tells you that in this case you should reload Snail Logo from the tape. However, it is possible to get back in without losing your program, and apparently without any ill effects, by typing GOTO 3010.

Verdict

Snail Logo is very slow and has a very limited range of commands and syntax. Although you can easily write very simple turtle graphics programs, anything except the simplest programming is very difficult and can be accomplished only by using opaque coding tricks. These may have been necessary in the days when computers had miniscule memories and could be programmed only in assembly language, but are frowned upon in educational circles today, when we have large amounts of memory and a profusion of structured high level languages.

The limitation to a few single-letter variable names, the necessity for using programming tricks in anything but the simplest programs, and the recursive procedure bug make it particularly unsuitable for young children, and the slowness makes it boring for anyone.

Snail Logo is cut down so much from the real Logo language that it cannot be recommended at all.

Rating

Features

Documentation

Performance

Useability

Reliability

Overall Value

Name Snail Logo **Application** Turtle Graphics **System** 48K ZX Spectrum **Price** £9.95 **Publisher** CP Software, 17 Orchard Lane, Prestwood, Great Missenden, Bucks **Format** Cassette **Language** Basic **Outlets** Mail order

Nigel Farrier tussles with 3D Supergraphics — but is the result a draw?

The Atari draws 3D

Supergraphics is a program which will project 3D colour images onto your Atari screen. Because of the speed of the drawing animation of the image is possible. It is also possible to translate and rotate the image around any of the three Cartesian coordinates (the x, y and z axes). The main use of this program is as a software development tool.

Features

The first thing to do with this package is to get the demonstration program SG Demo up and running. This takes you through the main features of Supergraphics with some excellent graphics displays. First you have a representation of a fighter flying from the centre to the corners of the screen, rolling as it does so.

Next is a 3D representation of the Atari logo on a rotating board. The demonstration then takes you through all the possible translations and rotations. The final two demonstrations are excellent animated colour 3D pictures of a hang-glider doing some manoeuvres and a butterfly fluttering around the screen.

Supergraphics claims to be able to draw 3D colour objects on the high resolution graphics screen at rates of up to thirty per second. It can display three colours and inverse text, also in the high resolution mode, and allow you easy access and control from a Basic program.

The program actually uses two high resolution (Graphics 8) screens and flips between them. Image erasure and drawing is carried out on the invisible screen, thus permitting flicker-free displays. It then flips to the other screen and back fast enough to permit quite reasonable animation.

Documentation

The documentation that accompanies the program is something of a disaster area. It has not been thoughtfully written or laid out, and is very difficult to follow, far less comprehend.

It is claimed that it is geared to the person with a good knowledge of Basic and the workings of the Atari, but even so it does not come up to scratch. The key to the whole program working efficiently is how you set up your image table. The explanation of this is very scanty, and this does detract from what could be an excellent utility.

It took me sometime to understand what the instructions were getting at, and then a lot of trial and error before I could get an image on the screen. If the purpose of the program is to animate images, and you can't get the image on the screen in the first place, what use is it?

In use

Once you've initialised Supergraphics and got an image to appear on the screen, all commands to move it are made from Basic using a simple PRINT statement to a device previously opened, for example:

```
100 OPEN# 1,4,0,"G:"
110 PRINT# 1;"%RX 10"
```

This will rotate the 'X' axis 10 units, where one unit is the equivalent of 1.4 degrees. All commands have to be preceeded by the per cent sign, and must have a format that is not all that obvious, thus making debugging a challenge.

One good thing that is incorporated into the program is a loop instruction. If one wanted to rotate the x axis completely through 360 degrees in steps of 5.6 degrees (*ie* 256 units in steps of four), the Basic program to do this would be:

```
100 FOR X=0 TO 256 STEP 4
110 PRINT 1;"%RX";X
120 NEXT X
```

This would be rather slow using Basic. Supergraphics has a function which will replace this:

```
100 PRINT#1;"%RX0T 256 S 4"
```

There are a few drawbacks that have to be mentioned. First you have no room for error on what follows the per cent sign in the PRINT statement. If you get it wrong the most likely result is a system crash. Second, if you execute a PRINT statement without using the opened device, some weird things happen. Third, in using the loop as described above, the loop must terminate exactly or it will become endless, *ie* PRINT#1;"%RX 0 T 255 S 4" will not work.

Once you overcome all these difficulties and get your program running, Supergraphics is quite fast so long as you have set up your image table in the most efficient way.

You can also use the program to put text in several colours onto the high resolution screen, but there are several other utilities available to do that if that is all you want.

Reliability

Supergraphics can be relied upon to crash at quite frequent intervals unless you take great care what you type in. Having said that, once you get a working program it does become very reliable and virtually crash free.

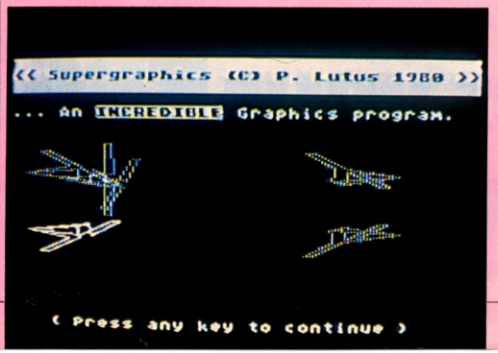
It is a pity that some sort of anti-crash system or error detection could not have been built in.

Verdict

As a 3D graphics program, Supergraphics is excellent. It works well and is quick. The accompanying literature is inadequate, poorly produced, and is grossly lacking in information.

Another example of this inadequacy is in listing of the program GRFBAS. The listing provided in Appendix E is not the same as the program GRFBAS on the disk. The listing is claimed to be an extended version, providing better capabilities for manipulating shape tables, but this should really have been provided on the disk as well.

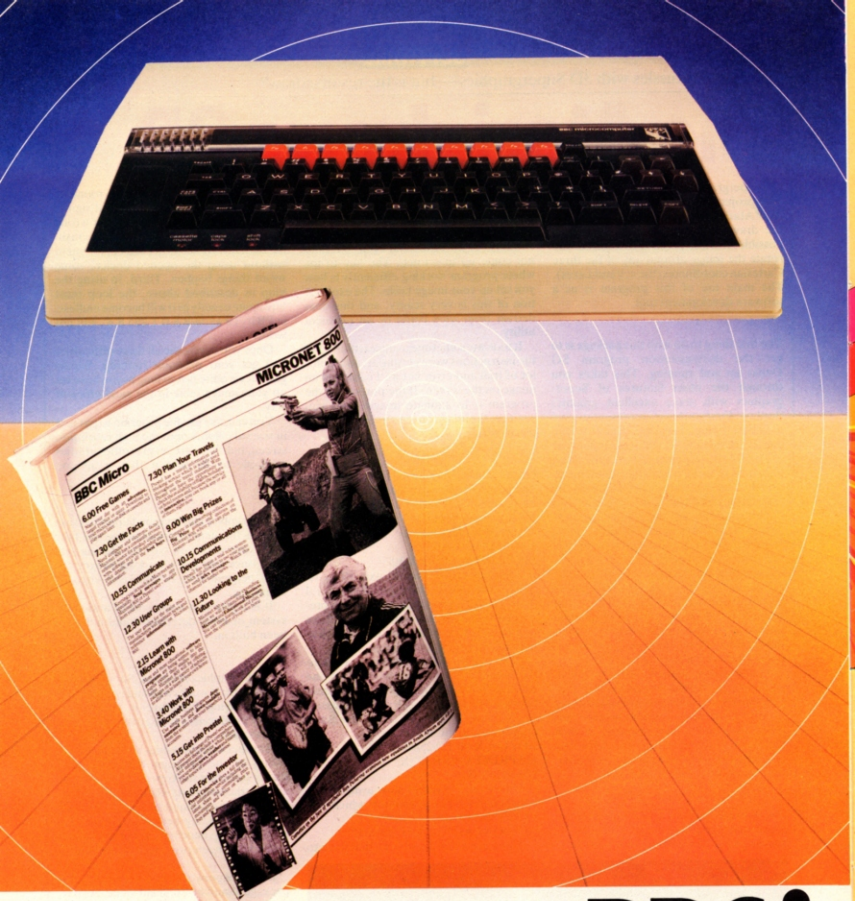
If the paperwork was improved, this package would be excellent value. As it is, the literature detracts from the quality of the programming.



RATING

Features	
Presentation	
Performance	
User interface	
Reliability	
Overall value	

Name 3-D Supergraphics **Application** Animation of 3D images **System** Atari 400/800 with 40K RAM **Price** £31.95 **Publisher** United Software of America **Format** Disk or tape **Language** Machine code but accessed easily from Basic **Outlets** Mapsoft.



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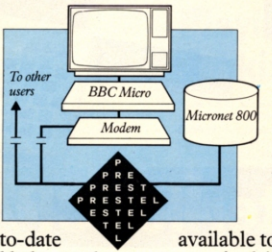

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One of the many faces on Prestel.

The Newbrain CP/M disk system is here! John Braga tests both the basic and expanded versions.

Sid Hughes

Your starter for CP/M

As this article goes to press, the future of Grundy Business Systems, the manufacturer of the Newbrain, is very much in doubt.

Put simply, the company has run out of money, and part of the reason for the collapse (*PCN* Monitor, issue 26) has been the continued non-appearance of the system we are reviewing exclusively here.

The promised CP/M upgrade for the Newbrain was always one of its main selling points. Users would have access to a standard operating system with all its attendant tried and true applications programs for a very reasonable price. Unfortunately, time passed the Newbrain by.

Now in late 1983, with the CP/M system just poised to come on the market, the Newbrain appears to many to be far too late arriving on the scene. Lacking colour and sound capabilities, it is clearly not designed to compete in the mad furious world of arcade games — but with its almost calculator-type keyboard it doesn't quite fit into the business market either. Then there is the LED display which seems to promise a certain amount of portability, but the rest of the machine doesn't really support it in this role.

So while it has attracted many by a neat appearance, good graphics and a high-quality display, the Newbrain has never quite scaled the heights.

People who already have Newbrains and are quite keen on getting hold of the long-promised CP/M upgrade can only hope that the company, or at least its profitable parts, will be bought out by another concern.

The minimum disk system consists of: the Newbrain itself; a TV, or monitor; a Disk Controller Module; a Disk Drive, 200K or 800K; a heavy-duty power supply; a CP/M master diskette and a handbook.

Before the crisis, Newbrain owners could expect to pay about £395 plus VAT for an upgrade. This was for a single 200K disk, plus the 32K already in the Newbrain itself. For a top of the range system (twin 800K drives and an additional 64K RAM) you would need about £1,300, excluding the basic Newbrain and monitor. Naturally, prices and supply sources are currently very much up in the air.

The cheaper system would certainly be very competitive. But what exactly do you get? What are the advantages over tape? What is the CP/M implementation like? Has Basic changed? Is 32K viable for a disk system? And do you get your programs transferred from tape? These are crucial questions for the future of the Newbrain.

Presentation

The Disk Controller is a module the same size as the Newbrain itself, but slimmer. It comes with a cable that attaches to either the Newbrain, or — in the case of the larger system — to the expansion box, which is a unit of the same neat size.

The controller handles up to four disk drives, which are of the popular half-height 5in type. 200K or 800K drives are available, the latter having the sort of capacity which will satisfy most commercial users. The smaller ones will suit most hobbyists very adequately.

To handle the new board or boards, a heavy-duty power supply is needed. This comes with four leads, three of which are needed for the Newbrain, the disk controller, and the expansion box if fitted. The drives have their own internal power supply, so by now you will probably have an unsightly tangle of cables.

If you are buying a disk system from scratch, you will no doubt receive only the heavy-duty power supply. However, if you are upgrading, you may be able to exchange your old power supply and pay only the difference for the new one.

A CP/M diskette and a Newbrain disk handbook come with the system. The standard CP/M documentation from Digital Research is not provided, and although most users won't need it, if you plan to

delve into CP/M's internals you will need to buy the manuals separately or invest in some of the specialist CP/M books.

The Starter System

To get started you plug in a disk controller board, fitting it under your Newbrain, and a disk drive. Then connect up the large power supply and switch on — the sign-on message displayed is exactly the same as on an unexpanded system:

NEWBRAIN BASIC
READY

The command PRINT FREE shows exactly the same memory free as before, but entering the command LOAD "ABC" starts the disk-drive instead of the tape.

In fact, the new disk controller has memory of its own, and the Newbrain operating system is clever enough to detect at power-on that there is another board in the system. So Basic has adjusted itself to load from disk rather than tape.

Apart from the loading and saving, Basic turns out to be much the same, with just two new commands, SAVF and CPM, and some new device drivers. SAVF acts like SAVE except that it saves programs in a way that allows them to be loaded faster. But newbrain Basic is very slow loading programs from disk. A large program can take 30 seconds to load, probably due to the way the interpreter/compiler is designed rather than to the speed of the disk transfer. It's slightly disappointing, but a vast improvement on tape.

The new device drivers (Newbrain Basic's way of accessing files) allow considerable flexibility in handling disk files — sequentially or directly. There is also a driver that allows you to put CP/M commands to the drive from within Basic. This will be extremely useful, but is not for novices. The handbook gives an example, showing how DIR can be used from within Basic to print the directory, but is vague on the details of the codes employed to drive the system. This is not the only point where the documentation is a little sparse.

If you use the command CPM, the screen alters immediately to 80 columns, a CP/M sign-on message appears and the disk in drive A is booted with the prompt A>.

A directory of the disk provided shows that most of the standard CP/M programs are there — but MOVCPM is not. On most systems this is used to tailor CP/M to suit different memory sizes. Using DDT to examine the memory shows that you have about 28K for user programs, which is what one would expect.

This will be not enough for most commercial programs, but Basic programmers should be happy, considering the Basic is in ROM and does not eat into the precious RAM. And assembler programmers will be swimming in the stuff.

The disk seems much faster under CP/M, indicating that much of the apparent slowness was Basic loading byte by byte rather than the Newbrain CP/M implementation. The screen under CP/M emulates the Lear Seigler ADM3A, which means that nearly all commercial CP/M programs will run without problems — provided you can buy them in the right disk format.

The Newbrain CP/M system includes the ability to read many other types of diskette, such as the Superbrain. This is extremely useful, and should make it easier to buy programs, but the program CONFIGUR, which is used to set up drive B to read the 'foreign' diskette, is virtually incomprehensible to all but computer engineers, and needs very careful handling. Documentation in the handbook is almost non-existent on this point, so make sure you get a sheet of examples from your dealer.

Returning to Basic is easy. There is a program called Exit provided on the diskette. Invoking it causes the screen to revert to 40 columns, and the Basic sign-on message reappears.

Verdict on the Starter System

So in summary, what does the Newbrain Disk Start System give us?

- The ability to run tape-based Basic programs unchanged, except that loading and saving programs will be far easier and quicker, and if the programs use data files they will now run much faster.
- Access to a true CP/M environment with the ability to buy programs 'off-the-shelf', provided they run in a 32K system. This is more than enough if you are an Assembler programmer, but most commercially available programs, such as Wordstar or Supercalc, will not run.
- An excellent start towards a 64K CP/M system.

The Expanded System

Upgrading the Starter System to a full-blown CP/M system is remarkably easy. You separate the Newbrain from the disk-controller board and connect the paged memory expansion box between the other two units. When you power on, the disk drive remains silent, as in the unexpanded system, but the familiar sign-on message is replaced by:

Newbrain paged system main menu
Move cursor and press newline
BASIC
CP/M 2.2

The cursor is sitting above Basic, so to enter Basic you merely press down-arrow once, then newline. The usual Basic prompt appears. If you press down-arrow twice the CP/M sign-on and prompt appear, and the disk comes to life.

I assume that the reason for the different approach between the expanded and unexpanded system is that the larger system is meant to allow expansion into other software besides Basic in additional ROM — perhaps a word processor or a spreadsheet package. The 'paged system menu' will then perhaps be expanded.

Once in Basic, a PRINT FREE reveals 40881 bytes available. This is some 10K more than on an unexpanded system, it is true, but a far cry from what might at first be expected. But Basic can't address much more than this without help, since the 24K of system ROM is presumably still needed, and more than a 64K address-space can't be accessed.

Page expansion might be one way out of this, but there is no hint as to how this can be used in Basic in the handbook.

Apart from the extra memory, the Basic does not, on the face of it, have any extra features. You switch to CP/M by typing EXIT, instead of the CPM of the unexpanded system.

Once in CP/M, a check reveals that this time the CP/M is a maximum size one, with the BIOS starting at F400h. Ample room, then, for any commercial CP/M program likely to be needed. And a nice touch, this — diskette provided contains samples of many programs such as SUPERFIL which you can evaluate at some length.

As far as printers are concerned, if you've had a serial printer running on the Newbrain, you will see no change. Using it on the CP/M system is more tricky, since you have to set up the baud rate via the largely undocumented CONFIGUR program, and you may need assistance from your dealer.

Users with parallel printers will spot the Centronics interface on the expansion board. But there's very little information on it, or whether it works with all Centronics-type printers.

How about programs provided on the CP/M disk? There are several of interest: A renumber program, which remedies a long-standing deficiency in the standard Basic; a transfer program, which allows you to move programs from cassette tape to disk, and back again if you wish; a set of demonstration programs written in Basic, which give a useful overview of the system's capabilities, both present and future, and the Configur program described previously.

Verdict

This is an attractively priced system which can be added to as funds permit. The starter system is an excellent introduction to CP/M, and the ability to read other formats of diskette is a decided advantage. Internal changes to Basic mean very few modifications, if any, to your existing programs. The drives have a large capacity, and there is a good range of sample programs on the diskette. And the CP/M is 'clever' — it adapts to two different memory sizes without the use of MOVCPM.

Of course there are snags. The metal housing (free with the larger system) is as attractively styled as a tea-chest. The Basic is slow to load programs, although the native CP/M mode seems fast enough. The documentation is patchy; while the handbook contains a few examples of Basic programs using disk files, it gives only an incomplete set of error messages (I encountered one undocumented) and there is a woeful lack of information on the Configur program, setting the printer baud rate, attaching a parallel printer and taking advantage of the memory expansion that is possible.

But all in all, it's a reasonably neat implementation which will please most users, provided they can overcome the gaps in the documentation.

Ian Scales meets the LogiMouse, and leads the rodent plague into the depths of *PCN*.

IBM LogiMouse squeaks for itself

As we said in last week's background mouse piece, the mouse is all very well as a concept. It represents a friendlier way of getting information into, or controlling, a microcomputer.

Unfortunately, things being as they are in the microcomputer industry, a good idea or even a good product is not enough to make a really useful tool — it takes blanket support from the various arms of the industry (applications software companies, computer manufacturers, even, dare we say it, the computer publications industry) before a new concept can take off.

The real potential of the mouse can be exploited only with software that has been specially written to go with it, since the mouse approaches the 'user interface' in a radically different way. Isolated mouse products, however, can be useful items for moving a cursor about the screen, especially for word processing editing, but it's important to remember that a mouse does not a Lisa make.

The LogiMouse is a substantial, fist-sized mound of plastic with three control buttons for the first, second and third fingers. Its way of sending cursor control and key codes to the computer is to physically interrupt the keyboard cable (without disabling the keyboard, of course).

This means you don't have to install an expensive interface. Instead, LogiMouse comes with its own adaptor, called LogiMate, which sits out of the way round the back of the PC where the keyboard socket is located. This system has the advantage of freeing your work space from an untidy clutter of wires.

The product's manufacturer, Logitech, is no Mickey Mouse outfit. The LogiMouse boasts a substantial ten-year life span — this, says Logitech, has allowed the company to further refine an advanced product.

It uses a single ball in the mouse's belly to generate the cursor movement information. So you are not restricted — as you are with the M1 — to a specified surface.

The mouse can be manipulated on whatever is handy — you can even do it on your knee or the book you're referring to if space becomes limited. But you do have to be careful about which way the mouse is pointed when you move it, since it uses its ball's rotation relative to the way it happens to be facing at the time to decipher the cursor movement. In practice this presents no problems — you and your mouse soon become a well co-ordinated duo.

At first sight, the price tag of £395 seems steep, but as was mentioned earlier, you get away without having to configure an interface in the IBM. If you have the requisite 'Com' already, you may find it cheaper to look for a mouse which makes use of it.

The software

The system also comes with some disk-based software, so you can configure it to your applications packages. As is usual in the mouse field, the LogiMouse has three buttons on-board — manipulated by the first, middle and third fingers with thumb and pinky holding on to the outside so you can move the thing around.

Without user intervention the three keys have a default mode which generates the function keys 8, 9 and 10 respectively. The software lets you get at the X and Y scaling factors and designate IBM scan codes for the buttons.

When Logimate is powered on, the X and Y scaling factors (the relationship between the distance you move the mouse on the table and the distance the cursor moves on the screen, plus the ratio between horizontal and vertical movement) are set to 8 and 16 respectively, so there is a two to one ratio between the horonzontal and vertical.

Depending on your application you may find it necessary to change these, expecially if you are going to move cells about or handle high-resolution graphics.

The most important part of the software allows you to configure the codes applicable to your applications package. You set up your own datafile by specifying the IBM scan codes (they're in the IBM manual) for each of the three keys. You obviously create one of these parameter files for each package you use. You could also have two or three for one package, depending on what you're doing.

For word-processing, for instance, you could have one set of parameters for entering text and a separate one for going back and editing it.

The commands are quite simple; for instance:

LOGIMATE L57 M 14 R 29

The letters specify left, middle and right and the numbers are the scan codes for space, backspace and return. This could be a good system for editing text.

Sending control codes is fairly simple as well. You have to specify a control-down code, then the character and then the control-up — this being constructed by adding 128 to the value of the key.

Control-C is specified by:

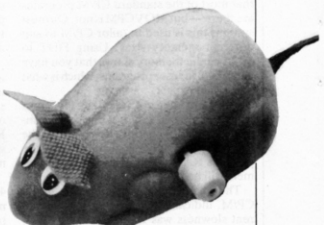
LOGIMATE L 29 46 157

As you can see, it is possible to send multiple characters for a single mouse key depression — up to eight in fact.

The LogiMouse is a likeable product and no problems were experienced using it. It is unfortunate that it does appear a little less flexible than most — there are, for example, no facilities for multiple depressions of each of the three buttons to give you a wider range of commands under your finger-tips.

On the positive side it is physically robust, and the fact that it can be configured to a bare-bones IBM PC alleviates its hefty price tag.

Item LogiMouse **Manufacturer** Logitech **Computer** IBM PC **Price** £395 plus VAT **Contact** Bonsai, 112 New Oxford St, London W1. 01-580 0902.



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Mouse Systems puts a rodent in your PC

The M-1 Mouse comes from the USA with the compliments of the definitively-named Mouse Systems Corporation. This mouse uses an interesting method of translating information to its computer. Instead of a track-ball, it has an optical system using a technique similar to a bar code reader. This means you are restricted to manipulating the mouse on a special pad. With the alternative track-ball method you can vary your mouse work area—all you need is a flat surface.

The M-1 mouse comes with a full life support system, but your IBM must be set up with an RS232 serial interface. This has to be resident in your IBM or configured before the mouse can be used.

As the mouse uses an optical system to send information to the computer, it obviously needs some power. This is provided by a separate transformer which must be clicked-in to the RS232 interface converter (another small black box).

The pad on which the mouse moves about is about the size of a typical screen (11in by 9in) and looks and feels like a large table mat.

So what you end up with is a transformer connected to a wall socket. The transformer is then connected to the RS232 converter. This runs to the standard IBM D socket on the RS232 interface in the PC and to the Mouse in the other direction.

Three buttons per mouse has become the standard way of sending commands to the computer once the cursor has been positioned. The M-1 has three buttons allocated to the first three fingers — thumb and pinky do the job of holding the mouse and moving it round in the right direction.

Each of the three buttons can understand up to three clicks in a row, giving the user a choice of nine functions through the mouse at any one time. The mouse is nicely designed and easy to hold, though it doesn't really feature a power grip — it must be held delicately.

Peter Smith

The Mouse works by calling two routines — Mousesys and Mouseset. Mousesys is described as a PCDOS resident driver, and links itself with the operating system to convert mouse movements and button clicks into keyboard character sequences. When you move the mouse, for instance, it sends a series of cursor movement characters into the system keyboard buffer — the same with the button clicks.

It is possible to set up your own parameter file by running Mouseset. This reads a specified input parameter file to define the character string assignments for each function. What this means is that you can run Mouseset to set the mouse up to execute the commands you want.

The IBM Personal Editor, VisiCalc, Wordstar, Lotus 1-2-3 and CompuView V-Edit can be configured straight from the Mouse system disk. Other applications packages must be configured by the user.

In a way the flexibility unavoidable with this approach to configuring the mouse should make it an interesting device for people who prefer to set up their packages to perform the way they like them. But those who prefer to have things handed out on a plate (and when you're paying lots for hardware, applications packages and mice, why not?) may find the whole procedure a bit annoying.

Depending on the way you like to do things it is possible to change parameters such as delete. On the resident driver set for WordStar operation, for instance, it takes three clicks of the right finger to perform a delete function.

Although this builds in a safety margin — you don't see unwanted deletions being executed simply because in a weak moment you twitched one of your fingers — deleting is one of the most used editing functions. Better, perhaps, to devote the delete function to a single-click command, especially if you have good hand-eye coordination. All this is obviously possible if you can get in and set it up the way you want it.

'This mouse uses an optical control system'

Starting up requires calibrating the mouse to the pad. It also automatically performs a self-test which is invisible to the user. Calibration requires you to run the mouse over the surface of the pad for about ten seconds in a circular motion.

If successful, calibration can be verified by turning the mouse over and checking that one of the red LED lamps stays on when any of the mouse's buttons have been pressed.

Verdict

The documentation is a little disappointing. All the information is there, it's just that it tends to be on the terse side, produced in photocopy form and stapled together. In operation the mouse was fairly easy to use, except that you tend to find yourself limited by the necessity to stay on the pad.

All the extra little boxes and wires necessary to get mousing can also be a bit of annoyance.

So it really is a question of how often you intend to use it.

Item M-1 Mouse **Manufacturer** Mouse Systems **Computer** IBM-PC **Interface** RS232 **Price** £297 **Contact** Data Design Techniques (0332) 360814

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CHOOSING A HOME MICRO

WARNING

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

THE PITFALLS

"DON'T LET THE ADD ONS ADD UP"

A number of large companies are offering packages that seem to be good value and low cost.
These offers usually have a hidden sting inasmuch as the essential accessories such as connection leads, peripherals and software often carry very high cost premiums.
e.g. software for low cost hardware usually costs between £29 and £49 for a ROM cartridge!!

CHECK THE QUALITY OF THE PRODUCT.

Raw materials are now an area where corners can be cut, and shoddy workmanship during 'building' can effect the 'up-time' of your unit.
Areas to watch out for are unreliable edge connectors, corrosion and poor quality P.C.B.s. Low quality components and bad design will seriously effect the reliability of the end product, and can lead to false economy.

DON'T BUY A GAMES MACHINE

Unless you want just games and nothing else! With a games computer you are limited.
Some computers, however, have the advantage of both games facility plus the whole world of computing to explore, as your interest and skills develop. A real computer system will allow you to expand your knowledge of the Hi-Technology world, and help earn its keep with its added uses in the field of education, communication and home business use.

SOFTWARE

Make sure the system you choose has a growing library of support software, to enable you to realize the full potential of your machine.

KEY POINTS TO LOOK FOR

● High Resolution Colour

In general most home computers have a poor graphics resolution (or detail). Check on the vertical and horizontal resolution in graphic mode and multiply the two numbers together. If the result is less than 35,000, then the graphics can hardly be considered high resolution. Without high resolution graphics displays such as those used in games tend to be "Chunky" in appearance.

● High Quality Sound

Some computers claim to provide a sound channel when in reality all that can be found inside the computer is a small buzzer controlled by electronic pulses. At the very least a sound facility should provide more than one channel and a raise channel as well (for gun shot effects in games for example). The best systems also provide envelope control of the sound channels to produce very sophisticated effects; very important for generating music. Also look for the ability to connect to external amplifiers.

● Keyboard

For accurate entry of programs and data into a computer it is important that the keyboard has a good tactile feel in operation. Coupled with acoustic feedback the user is fully aware when the computer has accepted his/her actions. Also of importance in a keyboard is layout. A standard computer keyboard layout will familiarise the user with the vast majority of computers used in the world of business and professional applications; very important if the purpose of purchasing a computer is educational.

● RAM

One of the most important features of a computer is the amount of RAM, or memory, included. In general the more powerful and exciting a computer program is the more RAM it requires. But take care, all computers are advertised quoting the total RAM used in the system. Computers use up a great deal of their own RAM for storing essential data and particularly in supporting the graphics display and the CPU. If it is less than 32K think again, is it enough?

● Computer Language

It is too difficult to program a computer in its own binary language so high level languages are used, the most popular being BASIC. However, there are a number of BASICs, some being very different from the rest. A de facto standard in the computer industry is Microsoft BASIC. Learn this one and you will be able to program in the majority of computer BASICs; such an important point if a home computer is to be used to educate your children to face the technology of the future.

● Expansion

As your interest and knowledge of computing grows, you will need a computer system that will grow with you: able to accommodate Printers, Disk-drives, Joysticks, Communications Modem, and Colour Monitor, as well as produce HI-FI sound effects.

Choosing the right system carefully will save you from throwing your money away. Check full specification, plus peripherals and software prices, before you buy. Preferably choose a Real computer system that can expand to meet your needs.

● Software

The computer you choose should have a growing selection of utility software to make the most of its capability.
Remember, computing is here to stay. You can't learn to compute on a toy, or a device which does not behave like a real computer.
In short, look out for a computer which offers all the points above, and you will be sure of getting the best value for money.

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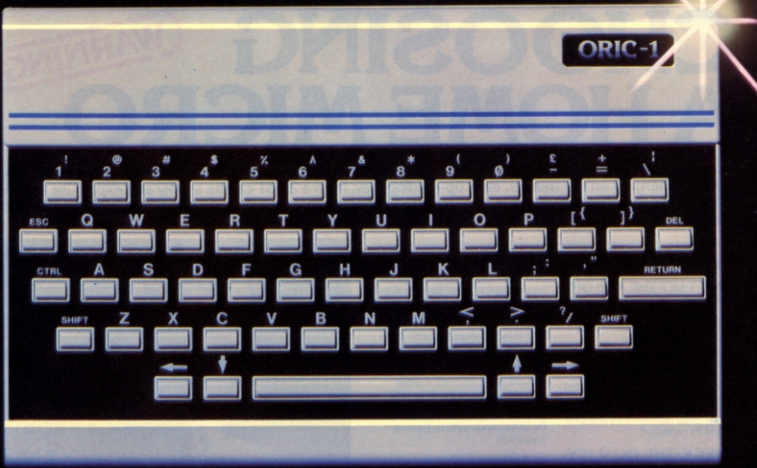

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ADVENTURE

COMMODORE 64

No city of angels

Name The Witness **System** Commodore 64 with disk drive **Price** £34.95 **Publisher** Infocom **Format** Disk **Language** Machine code **Outlets** Carousel Software, 36 Harlow Park Crescent, Harrogate, Yorks, some software dealers.

It was a cold Los Angeles February morning when the telegram arrived on my desk down at police HQ. On the face of it, it told just another LA story: wealthy philanthropist gets threatening note from some two-bit grifter. What made me slump a little straighter in my chair was the name of the pigeon — Freeman Linder, whose wife just happened to shoot herself in the bathtub a couple of weeks earlier.

He wanted me at his cosy country mansion that evening. How could I refuse?

Objectives

It looked like a short job anyway. Check out the family and staff, get the name of the letter-writer, warn him off, forget about it. I might have known there'd be more to it. They say the hardest crime to crack is the one with no apparent motive. I know better now. The hardest crime is the one that hasn't happened . . . yet.

Presentation

The set up, as you could guess dealing with this kind of class, is as cute as Christmas — bright and brassy and all wrapped up in a smart package. I took the time for a short drink and a long study of the file: the telegram, Mrs Linder's farewell note, a matchbook found near the house bearing the phone number Chandler 1729 (could someone be pulling a gag?). There was also a copy of the local newspaper of the day after the apparent suicide and a copy of the Detective's Gazette.

After that I headed up into the hills above Hollywood.

In play

The house was nice in the kind of understated way that whispers 'money' so loud your ears hurt. Inside I met the inscrutable oriental butler, Phong, Linder himself, looking nervous and applying himself to a drink with admirable dedication, and Monica the daughter, a good-looking broad who'd probably plug you with a .45 if you called her that within earshot.

When it turned out that the poison pen writer was none other than the late Mrs Linder's former lover, I figured I could take some of the philanthropist's scotch, make my excuses and leave.

Before I got around to part one of the plan, Linder's on the floor bleeding to death, lover boy is caught skulking around the garden and everybody in the house suddenly looks as suspicious as a wedding party at Wrong-Way Wendel's dice emporium.

I'd given myself 12 hours to solve the case. With more than an hour of that time gone, I suddenly realised I'd been looking the wrong way and then found myself the star witness in a murder story that would have reporters trampling old ladies to get in on it.

Like I said, the Linder place is no shack. You could get lost wandering around the closets in there. Bedrooms off corridors, separate bathrooms all over the house, yards outside that end in closed gates and fences, rooms that lead to other rooms and bring you back to where you started.

A wise detective would make a map. I got wise after ending up in the laundry a few times.

Creepy too, wandering around the house, not knowing whether you'd bump into some knife-wielding maniac or hear the crack of a pistol just before the bullet took you between the shoulder blades.

And what a crew of suspects. Strong, silent Phong, who'd been promised wealth in the land of the free and found lots of promises, little freedom and no wealth. Or lover boy with a professed hatred of guns and such an air of innocence I almost believed him. Almost.

And Monica, the bachelor heiress who probably wrestled bears on her weekends off.

Maybe Linder knocked himself off, unable to stand the shame of his errant wife's suicide, setting his rival up for the rap.

Still, snooping around paid dividends — as always — and asking a few tough questions, making easy with Linder's booze, and waving the few clues I had around provided some food for thought.

That false arrest won't look too good on the record though. Luckily I was able to go back and have another crack at it — treading a little more carefully this time.

Of course, I salvaged my tattered reputation and blew the case wide open.

But it took a good deal longer than my original 12 hour deadline.

Verdict

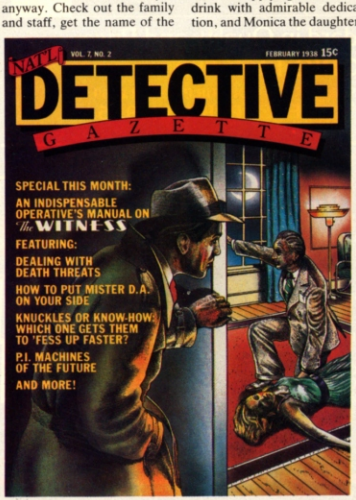
Guilty as hell. Guilty of purveying another entertaining, funny, addictive adventure. I hope those people at Infocom get everything they deserve.

Whodunnit? There is such a thing as police confidentiality. You should try it yourself, although police pay being what it is, for a small consideration I could be encouraged to squeal.

Peter Worlock

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	



BLOOD AND SAND

ORIC

Jump-jet flak dash

Name Harrier Attack **System** 16 or 48K Oric 1 **Price** £6.95 **Publisher** Durell Software, Castle Lodge, Castle Green, Taunton, Somerset **Format** Cassette **Language** Machine code **Other versions** Spectrum

This is another from the Falklands War stable. Your mission is to take off from an aircraft carrier in a Harrier fighter, fly inland avoiding enemy ground-fire and missiles from enemy fighters, and destroy various targets on the sea and land as you go. You must fly till you reach the enemy base which you bomb and then fly back to, and land on, the aircraft carrier.

Objectives

The right and left cursor keys increase and decrease your speed, and up and down cursor keys are used to move your plane up and down to avoid enemy flak and missiles. The space bar fires short-range missiles horizontally from the plane, and the next line of keys (z to /) drop bombs.

Scoring is by gaining a certain number of points for each target hit, the number depending on what the target is: 200 for a tank or 750 for a patrol boat, for instance. If you successfully land back on the ship you also get a sound from the ships hooter and the offer of another sortie.

The tape is attractively packaged and the loading instructions couldn't be clearer. It takes about nine minutes to load, being recorded at only 300 baud.

In play

Once loaded, a simple title page appears detailing the highest score, last score and number of targets hit. At this stage the volume level can be altered by typing zero and using the left and right cursor keys. You can also choose a skill level from 1 to 5.

Up cursor lifts your plane off the ship and right cursor results in a very satisfying noise as your plane increases in speed. All you have to do now is fly fairly close to the ground, avoid enemy missiles where necessary, and bomb what you can.

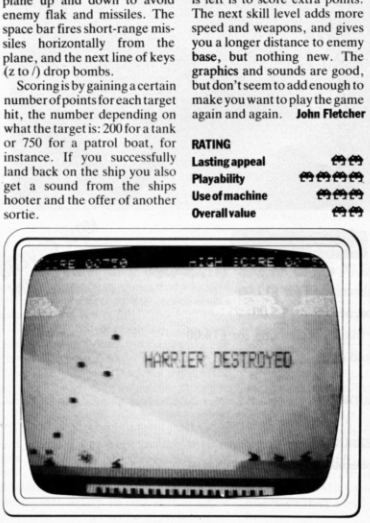
Landing back on the ship is no problem, since your plane automatically slows to zero speed just before the boat is reached.

Verdict

After a few goes the mission can easily be completed, and all that is left is to score extra points. The next skill level adds more speed and weapons, and gives you a longer distance to enemy base, but nothing new. The graphics and sounds are good, but don't seem to add enough to make you want to play the game again and again. **John Fletcher**

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	



DRAGON 32

Road to Morocco

Name Morocco Grand Prix **System** Dragon 32, one joystick **Price** £8 **Publisher** Microdeal, 41 Truro Road, St Austell, Cornwall **Format** Cassette **Language** Machine code **Other versions** none **Outlets** Mail order, most dealers

A game with the title of Morocco Grand Prix hardly needs explaining, except to wonder, why Morocco?

Objectives

With a hundred seconds ticking away, you must travel as far as possible along the track, which scrolls down the screen towards your car, avoiding collisions with the other cars, naturally enough. This is a one-player game, and a joystick is essential unless you want to spend the whole game in the pits.

Microdeal says that your joystick, in addition to controlling left and right movements, can be pushed forward for more speed or back for less.

In play

You first must choose which of the three coloured backgrounds to have. Once you've picked one you can't go back and sample the others without reloading the program. Black and white offers the best graphics, the others being green and buff. For some reason the buff screen doesn't allow you to see the seconds on the timer at the side of the track.

Beneath those is your car in the pits, and as it's only the distance covered on the track that matters you must find a gap in the traffic and move over at once.

One limitation is that the track is always straight, though it does change in width as it goes. The other noticeable drawback is that it's possible for two cars to touch without causing a crash.

When there is a bump, your own car goes whirling round like a catherine wheel back to the pits, but there's no limit to the number of crashes you can have in your hundred seconds at the wheel. Or rather at the joystick, control of which is perfectly smooth.

The only skill adjustment available is your own choice of speed at which to travel, which is good as very young children would probably find the slowest speed enough for them, while I found the fastest a challenge.

But there are also other faults, in that the table of top ten scores doesn't allow for the input of names, and the instructions have been cut out completely. At the beginning you're thrown straight into the game without warning, and it helps to know at the start whether you're racing against the clock, over a set distance, or whatever.

Verdict

Microdeal's standard pricing policy of £8 for everything means that a simple game such as this is probably overpriced, but for all its rough edges it should give you enough satisfaction if you're keen to race.

Mike Gerrard

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

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64 SPACE TALES

COMMODORE 64

Confined warfare

Name Stix **System** Commodore 64 **Price** £9.20 **Publisher** Supersoft, Winchester House, Canning Road, Wealdstone, Harrow HA3 7SJ **Format** Cassette **Language** Machine code **Other versions** None **Outlet** Mail order and most dealers

If you don't suffer from claustrophobia, enjoy low flying and positively welcome mass attacks by missiles and meteors then you'll feel at home with this version of Scramble, the arcade classic.

Objectives

Piloting a ship low over mountainous terrain, you must bomb enemy missile bases and helicopters and evade and shoot down whooshing rockets. Destroying enemy fuel dumps is a must as your own reserves are mysteriously replenished by such action. Surviving this barrage brings you to the cave where the ceiling and floor rise and fall. Meteor storms and a skyscraper city must also be weathered; altogether a total of eight sectors to be safely navigated before you reach the ultimate goal — the enemy's command centre.

In play

Movement up, down, forward and back is controlled by normal joystick movement (or by the keyboard, if you like). Pressing the fire button releases one bomb and a rocket. You don't get another until the first has exploded. Below you, smoothly scrolling past, is an undulating terrain, dotted with fuel dumps, enemy missiles and helicopters. At the bottom of the screen, score, sector, ships left, and fuel left are displayed. The fuel meter is a rapidly decreasing number, not easy to keep an eye on when the action is frenzied — a graphic bar would have been easier to see.

It is essential that almost every single fuel dump is destroyed as your starting supply is rather ungenerous. Running out of fuel is all too easy and has your ship plummeting out of the sky. I think the game has been made just a little too difficult by the comparative scarcity of fuel dumps — no doubt others will think it's a doddle.

The enemy rockets and helicopters are very well done and the cave impressively claustrophobic. A meteor storm is your next obstacle — these cannot be destroyed, so you must dodge and hope. The dangling carrot of the enemy command centre at the end keeps you trying.

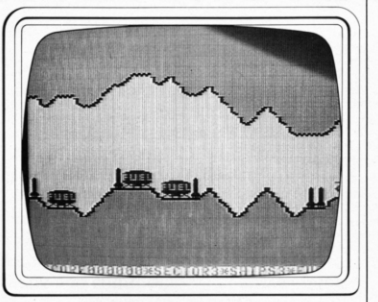
Verdict

A pretty exciting game. Well implemented with beautifully smooth scrolling and very nice graphics — shame about the strange ship. Good value for money and comes in an attractive video-style case.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	



COMMODORE 64

Playing for kix

Name Super Scramble **System** Commodore 64 **Price** £9.95 **Publisher** Terminal Software, 28 Church Lane, Prestwich, Manchester M25 5AJ **Format** Cassette **Language** Machine code **Other versions** Vic-20 **Outlets** Most retailers

If you're looking for an exciting and graphically excellent arcade game that doesn't involve annihilating aliens, then look no further. Stix is a superb version of Qix and will have you glued to your joystick.

Objectives

The Stix is a highly volatile bundle of energy trapped within the confines of your screen. You must restrict its frenetic activity by building force fields around it, gradually reducing the area it can operate in. These barriers are constructed with your field syntheiser. Two particles, a quark and an anti-quark, travel in opposite directions around the perimeter of the innermost field. One of your four synthesisers is destroyed if it collides with a quark.

If you pause while building a force field, an energy ripple strikes — it's like trying to flee from a fast burning fuse. It will destroy your synthesiser if it catches you before you complete the field. If the Stix touches any part of an incomplete force field, bang goes another synthesiser. Meanwhile, your energy level is going down. Filling 75 per cent or more of the area with force fields takes you to the next dimension.

In play

Although it may sound complicated, Stix is very easy to play. Your synthesiser is controlled by joystick movement or by the keyboard. Holding down the fire button and moving the joystick sets you off across the screen, a thick line indicating the boundary of the field you are constructing. Keeping the button depressed will earn you extra points but the field is drawn faster if you release it.

On completion of the boundary, there is slight pause while the field is filled with colour. Off you go again, all the while dodging the quarks, making sure the flying Stix doesn't hit an incomplete perimeter, and not pausing for fear of the dreaded energy ripple.

Achieving the required percentage in-fill takes you to the next screen where the action is faster, more colourful, and even less predictable.

Verdict

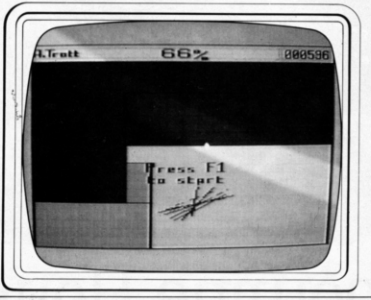
One major quibble — the score is shown none to clearly. Nevertheless, the graphical representation and animation of the Stix is masterly, as are the use of colour and sound. It has an aesthetic quality which, combined with the challenge, make it a compulsive game.

Nobody in my family could resist it and neither will you. Supersoft has produced a masterpiece.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	



The Hobbit. Now the best is

"After a very short time I found that 'The Hobbit' was becoming almost a way of life rather than a game, and so when I finished it for the first time I was partly sad because I felt that all the fun and adventure had ended, but I was wrong. Even now I am discovering new things about the game and feel that it will be some time until all of its secrets are revealed to me."

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writing a program like this must have be
enormous. The effects are brilliant to say h
least."

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reat to play and is No. 1 for
and excitement."

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"The most powerful computer game yet invented."

COMPUTER WEEKLY

"Within my circle of friends this game has become something of an obsession. We meet every Friday night at someone's house and spend 3-4 hours on 'The Hobbit'. Friday night would not be the same without 'The Hobbit'."

CHRISTINE VERCHILD, Wilts

"One new Adventure game stands head and shoulders above the rest. It alone almost provides you with a good enough reason to buy a 48K Sinclair Spectrum. Not only does The Hobbit produce drawings of the main scenes, but it also understands proper sentences rather than pairs of words for its commands. It comes with a copy of J.R.R. Tolkien's classic book of the same name. It is the program with the most detailed and best written documentation ever."

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"This is an impressively packaged Adventure game which makes good use of the Spectrum's colour graphics. They have not only produced one of the best games for the Spectrum, but given everyone else a lesson in good game design."

PRACTICAL COM

"I am the owner of a copy of 'The Hobbit' which is wonderful entertainment, and very challenging. I have other tapes and publications of yours, all of which are excellent."

MR. D.J. BURGH, Kent

"Having received the most excellent piece of programming I have ever seen, we have had no social life whatsoever. 'The Hobbit' has been dominating our lives since January and many nights have been spent until 3 o'clock trying to conquer it."

SIMON ROGERS, Avon

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...tulate you on a ... I have enjoyed ...hensely. I must thank you ...educing such a clever product, it ...as worth every penny of the purchase price."
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...VEN CASSIDY, Essex

...ing recently purchased a Sinclair Spectrum I decided to buy 'The Hobbit' since I have been doing a literature project based on 'The Hobbit' with my class of 10 and 11 year old children. Over the last 10 weeks the children, having read the book, have been attempting the program with my assistance. Let me congratulate you on a most entertaining program."
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POPULAR COMPUTING WEEKLY

"... the most unique factor of this program is that the user instructs the computer in completely ordinary English sentences. The Hobbit program is capable of very sophisticated communications ..."
ZX COMPUTING

"I purchased 'The Hobbit' not long ago and since then I have been engrossed in the game, and I'm beginning to think no-one wants to talk to me as all I talk about is my adventures in, 'The Hobbit'."
DAVID ROWLEY, Stoke-on-Trent

"The use of graphics is one of the features which makes The Hobbit special. The addition of graphics as good as these adds a whole new dimension to the Adventure. It is certainly a marvellous game, which should set the standard for future Spectrum adventures."
ZX COMPUTING

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- ☐ Dragon 32 Hungry Horace £5.95

BBC
- ☐ BBC "The Hobbit" Cassette £14.95

ORIC 1
- ☐ Oric 1 "The Hobbit" 48K £14.95

All versions of "The Hobbit" are identical with regard to the adventure program. Due to memory limitations, BBC cassette version does not include graphics.

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ADVENTURE

ZX SPECTRUM

Riddle of the sands

Name Pharaoh's Tomb **System** Spectrum 48K **Price** £4.95 **Publisher** Phipps Associates, 172 Kingston Road, Ewell, Surrey, 01-393 0283 **Format** Cassette **Language** Machine code, some Basic. **Other versions** Limited version for 16K ZX81 **Outlets** Mail order, most specialist computer shops

The only introduction needed for this piece of software is to say that it is an adventure combining graphics and text, set in the rooms and caves of the tomb of one of the Pharaohs of ancient Egypt. These must have been pretty restless corpses as the tomb comprises 62 rooms — including a rest room — and I'll leave you to wonder what ancient treasure you may or may not find there.

Objectives

The opening screen tells you: 'I am standing at an oasis in the Egyptian desert, close to a place where rumours suggest that an ancient burial place exists. To win, I must gather all the golden treasures that I may find and place them by the oasis.'

For each of the treasures you gather you collect points, the points increasing if you take the treasures out of the tomb and to the oasis. Your goal is the maximum tally of 1,520, and you can find out how well you're doing at any moment by simply typing SCORE. There is one other tiny objective as well, I suppose, in that like most adventure games your chances of winning are increased considerably if you manage to stay alive, though if you're going to die somewhere it might as well be in a luxurious tomb such as this.

First impressions

The cassette inlay is a professional job, and for once it is fairly restrained, avoiding those garish drawings and wild claims made by some companies who say 'This game will scare you half to death,' and suchlike nonsense. The inlay contains the loading instructions, the tape offers two copies of the program, and the program incorporates the simple playing instructions. Phipps Associates also offers to send you the solution if you're screamingly desperate. What more could you ask?

In play

You begin at the oasis, with a path to the north, steep steps going up a mountain, and a book of matches lying at your feet. As on all screens, a helpful compass appears in the top right corner pointing north.

The directions you can input are the simple N, S, W, and E, with the addition of Up and Down. The program recognises about 70 words in all, including the usual Get, Drop, Use, Look, List, Help and Quit. You shouldn't need the Quit option just yet, unless you can't decide whether to go north or climb the mountain, but if you use it later you will be offered the chance to save the game to tape, and this does seem to be

one of those games where the various objects stay where they are: put the matches down in one place and they'll still be there if you go back for them later.

The graphics occupy the top half of the screen, and are colourful and good without exactly being breathtaking, while the text scrolls up the bottom half. 'What do I do now?' your guide will prompt you, and the machine code word scanning ensures that he responds to your orders very quickly, even if it's only to say 'I can't do that now' or 'I don't understand.'

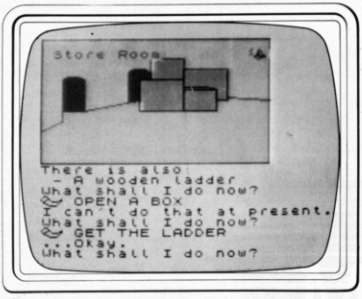
It isn't giving too much away to say that if you head north you arrive at the entrance to the tomb, where a large rock blocks the way in. An example of the game's occasional humour is uncovered if you request 'Move rock'. The answer comes back: 'Are you sure you want me to risk having a hernia?' Being a harsh taskmaster, of course I replied 'Yes,' to be greeted by a series of grunts while my guide made very heavy weather of moving the rock.

The first room is the Fire Room, at which point the matches promptly ignite, assuming you've brought them with you. As these will obviously be of some use later on, my first aim was to solve that problem, which was no mean feat as it involves a combination of two items and a thorough exploration of about a dozen rooms.

Other places you'll encounter include the Burial Chamber, Music Room, Death Row and the Windy Tunnel, which appears to be the only place where chance enters into the adventure. Apart from the treasures you'll find potentially useful items such as lamps, magic cloaks, fans and magic rings, and you can carry up to six items at one time.

The responses were more or less instant, and the only annoying delays occurred when I wanted to rush back to a particular room to try something out and had to wait while each of the rooms I passed through was drawn on the screen. Even though this only takes a few seconds, and there's probably no way round it, it does seem like ages.

The game itself was well worked out, and there were no simple answers to anything. Most hurdles to be overcome involved using at least a couple of items, perhaps carrying one thing while wearing something else, but afterwards all these answers seemed very logical . . . once you'd worked them out, of course. One area of the tomb has to be explored in a limited number of moves, before a door closes and locks you inside forever, while the almost impenetrable maze lived up to its name.



Verdict

Although I only unearthed one item of treasure in several hours of playing, I wasn't inclined to give up as each time I seemed to get just that bit further, tempted on. The game itself is like the graphics: good without being great. It's certainly not The Hobbit, but at less than a fiver it's definitely value for money.

Mike Gerrard

RATING

Lasting appeal	
Playability	
Use of the machine	
Overall value	

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For your collection of cards this week we have four new programs. From R M Butterman of the Netherlands comes a useful utility for the Oric 1 (16 or 32K), from Eugene Garvin of Galway City in Eire we have a Home Accounts program for the Vic 20, from David Hall of Podington, Northants there is a game for the ZX81 16K called Knockout Whist, and finally from Leon Goodfriend of Cardiff comes a clever utility for the BBC.

The Oric program allows you to redefine characters in the system. The program is menu driven for ease of use and presents you with an empty character in which you put the pixels. Once the editing has taken place, press the 'D' for define key and see the character redefined before your eyes.

The BBC utility allows you to print strings of any size anywhere on the screen. Both the X dimension and the Y dimension can be varied and the string is placed on the screen using the MOVE command. The routine makes use of the OSWORD ten call. This operating system call allows character definitions to be read. The definition is then decoded by this procedure into a set of variable size blocks, which are then plotted on the screen. Note the way in which the X/Y% and A% variables are used to pass values into the X, Y and A registers of the 6502, which is the microprocessor at the heart of the Beeb. The procedure should be typed into your machine and then *SPOOLed onto a tape or disk. To attach this procedure to any program, all you need to do is *EXEC the file back into the program you are running.

Some users with disk systems may find problems with this procedure. The memory location &DOO is used to store the character definition; unfortunately this location is also used by the DFS. To get around this, change the values of X% and Y% in line 32030 to X%=&70 and Y%=0, this will then store the character definition in the free memory on the zero page (see the memory map in the user guide).

Home Accounts is a program for the Vic 20. It allows Vic owners to keep track of their money. There are seven accounts, and data can be put in and taken out of them at will. Once all the data has been entered the balance can be displayed and the data can be saved to tape.

For the ZX81 we have a game. It is a version of the famous (or notorious) Knockout Whist. In this program, you pit your wits and your luck against the computer.

Finally, apologies to David J Peart whose program was published in issue 26 (Bar Graph for the ZX Spectrum). Unfortunately his name was spelt wrong.

If you want to see your program in print, along with your name, why not send it in to ProgramCards? We pay for any programs that we publish according to length, originality and good programming technique. Send them in on cassette or disk, or if they are short then a listing will do. All programs should be accompanied by a listing and a brief outline of how the program works, in the form of comments. As soon as we have looked at them and/or published them, they will be sent back at our expense.

PCN ProgramCards

Home Accounts Card 1 of 3

8328HA1/3

Vic 20
Commodore Basic
Application: Financial
Author: Eugene Garvin

```
5 GOTO20
6 PRINT"■"
10 PN$=RIGHT$(STR$(PN),LEN(STR$(PN))-1):RETURN
20 DIMT$(70),D(70):Q=36879
30 GOSUB100:IFA=7THENPRINT"■■"FRE(0)" BYTES FREE":STOP
40 ONAGOSUB200,500,700,800,900,5500
99 GOTO30
100 PRINT"■■──────────────────── OPTIONS ────────────────────"
105 G$(7)="INCOME"
110 POKEQ,110:PRINT"■1. AMEND ACCOUNTS":PRINT"■2. CHECK ACCOUNTS"
115 PRINT"■3. LOAD DATA":PRINT"■4. SAVE DATA":PRINT"■5. EDIT DATA"
120 PRINT"■6. DISPLAY TOTALS":PRINT"■7. EXIT PROGRAM":U=7
150 PRINT"■■PRESS KEY 1 -"U"■"
160 GETA$:IFA$=""THEN160
161 N=ASC(A$)-48:IFN<1ORN>UTHEN160
170 A=N:RETURN
200 GOSUB210:GOTO270
210 POKEQ,8:PRINT"■■──────────────────── ACCOUNTS ────────────────────
──────"
220 PRINT"■SELECT WHICH ACCOUNT■■":FORJ=1TO7:PRINT:PRINTJ"■■."G$(J):NEXT:RETURN
270 U=7:GOSUB150:POKEQ,107:GOSUB400
290 PRINT"■■INPUT EXPENDITURE":PRINTTAB(16);"■■"
```

5	Jump to main program	CONT can be used to restart the program if seven is accidentally selected	150-170 Get key from keyboard routine. Returns key in A and N
10	Format money value		200 Check account subroutine
20	Dimension arrays		210 Print title accounts
30	Main program, gosub to main menu. If option seven is selected then print the number of free bytes left and STOP the program.	40 Main jump table uses A to select which routine to execute	220 Print account names
		100-120 Display options routine	270 Gosub to get key routine, gosub print accounts subroutine
			290 Get expenditure

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Home Acounts Card 2 of 3

8328HA2/3

```
300 SN=(A-1)*10+1:FORI=SNTOA*10:PRINT"■"T$(I)TAB(13);:INPUTX:K=K+X:D(I)=D(I)+X:X
=0:NEXT
320 PRINT"■■TOTAL £";K:GOSUB6000:K=0:RETURN
400 PRINT"■■■
```

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PC3

PCN ProgramCards

Foot — Card 3 of 4

Continued from last week

8328FO3/4

```
2940 DATA 000000
2950 DATA 000000
2960 DATA 000000
2970 DATA 000000
2980 DATA 000000
2990 DATA 000111
3000 DATA 000011
3010 DATA 000011
3020 DATA 000011
3030 DATA 000111
3040 DATA 000110
3050 DATA 001100
3060 DATA 001100
3070 DATA 001100
3080 DATA 011100
3090 DATA 000000
3100 DATA 000000
3110 DATA 111111
3120 DATA 111111
3130 DATA 111111
3140 DATA 001111
3150 DATA 000111
3160 DATA 000111
3170 DATA 000111
3180 DATA 000111
3190 DATA 000000
3200 DATA 000011
3210 DATA 111111
3220 DATA 111110
3230 DATA 111100
3240 DATA 111100
3250 DATA 111000
3260 DATA 110000
3270 DATA 100000
3280 DATA 000000
3290 DATA 100000
3300 DATA 100000
3310 DATA 000000
3320 DATA 000000
3330 DATA 000000
3340 DATA 000000
3350 DATA 000000
3360 DATA 000000
3370 DATA 000000
3380 DATA 000000
3390 LET A$=CHR$(128)+CHR$(129)+CHR$(130
)+CHR$(131)+CHR$(132)+CHR$(133)+CHR$(134
)
3400 LET B$=CHR$(135)+CHR$(136)+CHR$(137
)+CHR$(138)+CHR$(139)+CHR$(140)+CHR$(141
)
```

3390-3430 Define A$ as top row, B$ as second, C$ as third etc

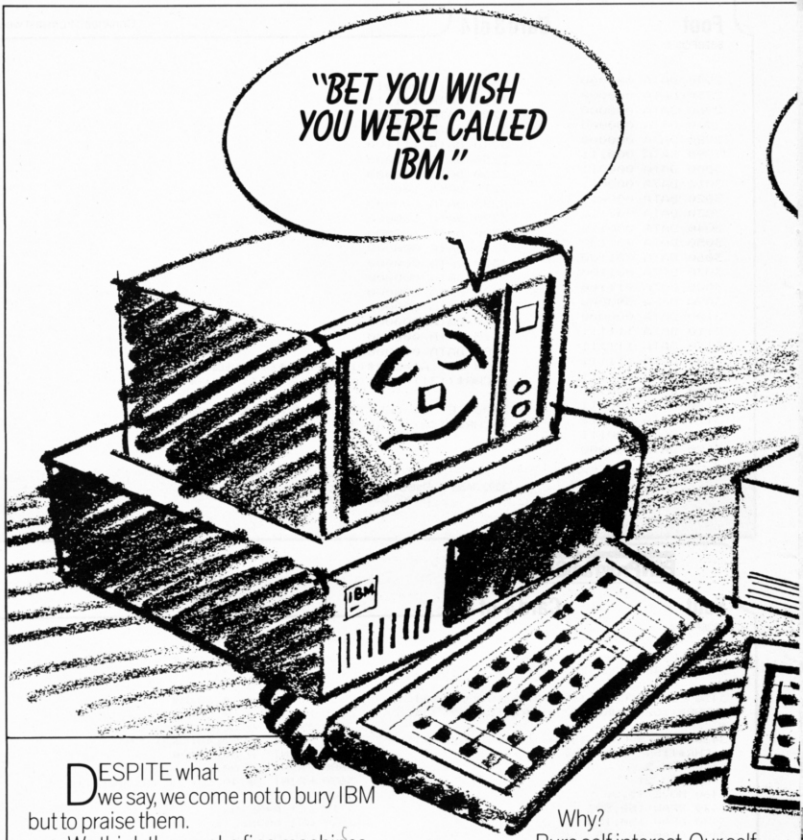
PCN ProgramCards

Foot — Card 4 of 4

8328FO4/4

```
3410 LET C$=CHR$(142)+CHR$(143)+CHR$(144
)+CHR$(145)+CHR$(146)+CHR$(147)+CHR$(148
)
3420 LET D$=CHR$(149)+CHR$(150)+CHR$(151
)+CHR$(152)+CHR$(153)+CHR$(154)+CHR$(155
)
3430 LET E$=CHR$(156)+CHR$(157)+CHR$(158
)+CHR$(159)+CHR$(160)
3440 INK 5
3450 VDU 21
3460 MOVE 95,80
3470 DRAW 150,80
3480 DRAW 150,155
3490 DRAW 95,155
3500 DRAW 95,80
3510 INK RED
3520 PRINT  @ 50,90;A$
3530 PRINT  @ 50,100;B$
3540 PRINT  @ 50,110;C$
3550 PRINT  @ 50,120;D$
3560 PRINT  @ 50,130;E$
3570 INK 6
3580 VDU 24
3590 PRINT  @ 24,20;A$
3600 PRINT  @ 24,30;B$
3610 PRINT  @ 24,40;C$
3620 PRINT  @ 24,50;D$
3630 PRINT  @ 24,60;E$
3640 PRINT  @ 80,20;A$
3650 PRINT  @ 80,30;B$
3660 PRINT  @ 80,40;C$
3670 PRINT  @ 80,50;D$
3680 PRINT  @ 80,60;E$
3690 PRINT  @ 40,80;"MR MICHAEL FOOT"
3700 VDU 25
3710 LET A=GET%
3720 OUT &0086,13
3730 FOR N=0 TO 32
3740   PAUSE 500
3750   BEEP N,5,63
3760   OUT &0087,N
3770 NEXT N
3780 FOR N=32 TO 0 STEP -1
3790   PAUSE 500
3800   BEEP N,5,63
3810   OUT &0087,N
3820 NEXT N
3830 GOTO 3730
```

3440 Define colour
3450 Put overwrite on
3460-3500 Draw square
3510-3560 Print picture in red
3570 Colour yellow
3580 Double height characters
3590-3680 Print two more pictures in yellow
3690 Name the picture
3700 Normal height characters
3710 Get key
3720-3770 Move picture and beep
3780-3820 Move picture left and beep
3830 Kep on truckin



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PCNProgramCards

Painted Characters Card 1 of 2

8328PC1/2

Oric
Oric Basic

Application: Utility
Author: R M Butterman

```
0 INK0
10 TEXT:PAPER 3:INK 1:CLS
20 POKE 524,127:POKE 618,2
30 A=46080:PLOT 9,1,"CHARACTER GENERATOR
"
40 FOR I=1920 TO 1959:POKE A+I,17:NEXT
50 POKE A+1960,23:POKE A+2000,23:POKE A+
2009,4:P0^E A+2040,23:POKE
A+2080,22
60 FOR Y=10 TO 17
70 FOR X=24 TO 29:PLOT X,Y,23:NEXT X
80 PLOT 30,Y,CHR$(19)+CHR$(0)+"0 ^
90 NEXT
100 PLOT 1,6,"- MOVE WITH CURSOR-KEYS"
110 PLOT 1,8,"- SPACEBAR SETS/ERASES PIX
EL"
120 PLOT 1,10,"- 'C' = CURSOR OFF"
130 PLOT 1,12,"- 'D' DEFINES CHARACTER"
140 PLOT 1,14,"- 'E' ERASES ALL PIXELS"
150 X=24:Y=10:E=23:PLOT X,Y,22
160 GET B$
170 IF ASC(B$)>11 OR ASC(B$)<8 THEN 190
180 ON ASC(B$)-7 GOSUB 500,550,600,650
190 IF B$=" " THEN GOSUB 700
200 IF B$="c" THEN PLOT X,Y,E
210 IF B$="d" THEN 300
220 IF B$="e" THEN 60
230 GOTO 160
300 PLOT 2,20,"REDEFINE WHICH CHARACTER
?"
310 GET B$:IF B$<" " OR B$>")" THEN 310
320 FOR I=2 TO 36 STEP 2
330 PLOT I,22,B$:WAIT 15
340 NEXT
350 PLOT X,Y,E:Y=10
360 FOR J=A+8*ASC(B$) TO A+7+8*ASC(B$)
370 W%=0:FOR I=0 TO 5
```

20	Caps on, cursor off	40-50	Plot colours	300-410	Define character
30	Address of standard character set; print program name. For ORIC-1 16k owners this line should be changed to: 30 A=13312:PLOT 9,1, "CHARACTER GENERATOR"	60-90	Plot 6 by 8 grid and values	350	Cursor off
		100-140	Instructions	360-410	Calculate and poke value
		150	Initialization: plot cursor		
		160-230	Main loop: get character from keyboard and jump to corresponding subroutine/line		

PCNProgramCards

Painted Characters Card 2 of 2

8328PC2/2

```
380 IF SCRN(29-I,Y)=16 THEN W%=W%+2^I
390 NEXT I
400 POKE J,W%:Y=Y+1
410 NEXT
420 PLOT 2,24,"ANOTHER CHARACTER ?     (Y
 OR N)"
430 GET B$:IF B$="n" THEN PRINT CHR$(17)
CHR$(20):CLS:END
440 IF B$<>"y" THEN 430
450 FOR I=2 TO 38:PLOT I,20,32:PLOT I,22
,32:PLOT I,24,32:NEXT
460 GOTO 60
500 IF X=24 THEN RETURN
510 PLOT X,Y,E:X=X-1:E=SCRN(X,Y):PLOT X,
Y,22
520 RETURN
550 IF X=29 THEN RETURN
560 PLOT X,Y,E:X=X+1:E=SCRN(X,Y):PLOT X,
Y,22
570 RETURN
600 IF^Y=17 THEN RETURN
610 PLOT X,Y,E:Y=Y+1:E=SCRN(X,Y):PLOT X,
Y,22
620 RETURN
650 IF Y=10 THEN RETURN
660 PLOT X,Y,E:Y=Y-1:E=SCRN(X,Y):PLOT X,
Y,22
670 RETURN
700 IF E=23 THEN E=16 ELSE E=23
710 IF SCRN(X,Y)<>22 THEN PLOT X,Y,E
720 W%=0:FOR I=0 TO 5
730 IF SCRN(29-I,Y)=16 THEN W%=W%+2^I
740 IF SCRN(29-I,Y)=22 THEN IF E=16 THEN
 W%=W%+2^I
750 NEXT
760 PLOT 31,Y,STR$(W%)+"  ":PLOT 31,Y,0
770 RETURN
```

420-460	Prompt for another character	450-460	If more then wipe out messages and characters and goto line 60	600-620	Subroutine cursor down
430	If no more then cursor on, caps on, clear screen			650-670	Subroutine cursor up
		500-520	Subroutine cursor left	700-770	Subroutine set or erase pixel, calculate and print new value
		550-570	Subroutine cursor right		

PCN ProgramCards

Card 1 of 5
Knockout Whist
8328KW1/5

ZX 81 16K
ZX 81 Basic

Application: Game
Author: David Hall

```
    0 REM * KNOCKOUT WHIST *
   20 RAND
   25 LET Z$=""

   30 LET U$="■■■■"
   35 LET 5U=INT (RND*4)+1
   40 GOSUB 9100
   45 LET T$=5$
   50 LET T=5
   55 LET PTG=1
   60 REM * START *
   65 CLS
   66 PRINT AT 10,5;"PLEASE WAIT
WHILE I";AT 11,5;"SHUFFLE THE CA
RDS."
   70 GOSUB 9200
   75 FAST
   80 DIM C$(14,2)
   85 LET TM=0
   90 LET TC=TM
   95 DIM C(14)
  100 FOR N=1 TO 2*5T
  110 LET R=INT (RND*13)+2
  120 LET 5U=INT (RND*4)+1
  130 GOSUB 9100
  140 IF R=10 THEN LET N$="■"
  150 IF R=11 THEN LET N$="■"
  160 IF R=12 THEN LET N$="■"
  170 IF R=13 THEN LET N$="■"
  180 IF R=14 THEN LET N$="■"
  190 IF R<10 THEN LET N$=CHR$ (C
ODE (STR$ (R+128))
  200 FOR I=1 TO N
```

```
  210 IF N$=C$(I)(1) AND 5$=C$(I)
(2) THEN GOTO 110
  220 NEXT I
  230 LET C$(N)(1)=N$
  240 LET C$(N)(2)=5$
  250 LET C(N)=R
  260 NEXT N
  270 REM * SET UP GAME *
  280 CLS
  290 SLOW
  300 PRINT "TRUMPS:  ";ME :0
YOU :0"
  310 PRINT AT 10,4;"I WILL NOW D
EAL THE CARDS"
  320 LET Y=2
  330 FOR N=1 TO 5T
  340 LET X=2
  350 GOSUB 9000
  360 LET X=16
  370 GOSUB 9000
  380 LET 5$=C$(N)(2)
  390 LET N$=C$(N)(1)
  400 PRINT AT X,Y;5$;AT X+2,Y+1;
N$
  410 LET Y=Y+4
  420 NEXT N
  430 FOR N=1 TO 5T
  440 PRINT AT 15,N*4-1;N
  450 NEXT N
  460 GOSUB 9050
  470 IF (TM+TC)>0 THEN GOTO 900
  480 IF 5T=7 THEN GOTO 900
  490 IF NOT CALL THEN GOTO 600
```

20	Set the random seed	110	Select a random card from a suit	200-220	Check that the card hasn't been dealt before
30	Set up string to draw cards	120	Select a random suit		
35	Pick original random trump suit	130	Convert the suit to a letter	310	Deal message
65	Print shuffle message	140-180	Convert cards into court cards	320-420	Deal the cards
100	Begin to shuffle the cards	190	If not a court card then put card number into an array		

PCN ProgramCards

Card 2 of 5
Knockout Whist
8328KW2/5

```
  500 REM * NEXT TO CALL TRUMPS *
  510 PRINT AT 8,6;"WHAT IS YOUR
CALL ?","■ CLUBS","■ DIAMOND
S","■ HEARTS","■ SPADES"
  520 IF INKEY$="" THEN GOTO 520
  530 IF CODE INKEY$<29 OR CODE I
NKEY$>32 THEN GOTO 520
  540 LET 5U=VAL INKEY$
  550 GOSUB 9100
  560 LET T$=5$
  570 GOSUB 9050
  580 GOTO 900
  600 REM * NOW CALL TRUMPS *
  610 LET TOT=0
  620 LET TO=0
  630 LET 5$="■"
  640 GOSUB 720
  650 LET 5$="■"
  660 GOSUB 720
  670 LET 5$="■"
  680 GOSUB 720
  690 LET 5$="■"
  700 GOSUB 720
  710 GOTO 900
  720 FOR I=1 TO 5T
  730 IF C$(I)(2)=5$ THEN LET TO=
TO+1
  740 NEXT I
  750 IF TO>TOT THEN LET T$=5$
  760 LET TO=0
  770 RETURN
  900 PRINT AT 0,7;T$
 1000 REM * COMPUTER TO GO *
```

```
 1010 IF PTG THEN GOTO 1500
 1020 PRINT AT 12,3;"ME TO GO NEX
T"
 1030 GOSUB 9200
 1040 GOSUB 9050
 1050 LET R=INT (RND*5T)+1
 1060 IF C(R+5T)=100 THEN GOTO 10
50
 1070 IF PTG THEN GOTO 1320
 1080 LET TO=15
 1090 FOR I=1 TO 5T
 1100 IF C$(I+5T)(2)=M$(2) THEN G
OTO 1220
 1110 NEXT I
 1120 FOR I=1 TO 5T
 1130 IF C$(I+5T)(2)=T$ AND C(I+5
T)<TO THEN LET R=I
 1140 IF C$(I+5T)(2)=T$ AND C(I+5
T)<TO THEN LET TO=C(I+5T)
 1150 NEXT I
 1160 IF TO>15 THEN GOTO 1320
 1170 FOR I=1 TO 5T
 1180 IF C(I+5T)<TO THEN LET R=I
 1190 IF C(I+5T)<TO THEN LET TO=C
(I+5T)
 1200 NEXT I
 1210 GOTO 1320
 1220 FOR I=1 TO 5T
 1230 IF C$(I+5T)(2)=M$(2) AND C(
I+5T)>NM AND C(I+5T)<TO THEN LET
 R=I
```

430-450	Number the cards	510-570	Player (not computer) chooses trumps and screen message is placed and then removed.	600-770	Computer chooses trumps using the subroutine at 720 to work out the number of similar suit cards and hence evaluate the trump choice
460	Remove the screen messages				
470-490	Select if trumps need to be chosen and if so who chooses them.	580	Continue game at 900	90	Print the trump suit at the top of the screen

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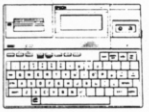

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Clubnet keeps you in touch with enthusiasts throughout the country. It is divided into clubs and user groups and a list of each is published on alternate weeks.

This week it is the turn of clubs, which are listed alphabetically by county and town.

If your association has something special on the agenda or if you've just started a new one, contact us at *Clubnet, Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HG.

Our Clubnet report this week focuses on the Keighley Microcomputer Club, W Yorks.

Discounts are in store

Keighley Microcomputer Club in West Yorkshire first met in August, drawing an astonishing 70 attendants. 'I was very pleased — it's encouraging,' said organiser Simon Midgley, who says there's great demand for a club like this in the area.

'Every age group was covered, from 14-year-olds upwards, with most people in their 20s and 30s,' he said.

The club was the brainchild of a group on a programming course at the local technical college, where Mr Midgley was being taught by Dr A J Warren, who is now the club's chairman.

Mr Midgley, who works with his father in the family business — a wholesale builders' ironmongers — says the club's committee is well kitted out with people with varied experience, ranging from those who teach computing at the local tech to an accountant and an electronics engineer.

At the introductory meeting, members discussed the future activities of the club. Future meetings with various micros available are planned, and the club hopes to buy its own hardware. Members' micros so far include a ZX81, a Dragon and a TRS 80.

Membership is £10 a year, £5 for students and unemployed, and there are special family rates. Members will get a newsletter, and software library, and discounts on specific machines are being negotiated. 'One of the stores in the local town has already offered us discounts,' said Mr Midgley.

The attendance at the first meeting was very encouraging.

Members now expect to have discussion groups, lectures, and guest speakers and representatives from specific micro firms coming to talk to them, as well as having stalls at local shows and exhibitions.

Wendie Pearson

Name Keighley Microcomputer Club **Venue** Methodist Church Hall, Market Street, Keighley, West Yorks **Meetings** Each Monday at 7.30pm **Contact** Simon Midgley, 0535 681463

CLUBS

AVON

Bristol Berkeley Nuclear Laboratories Club. Contact Neil Walker, 53 Wolfridge Ride, Alveston, Bristol, 0454 414262.

Bristol Micro Computer Club. Meets at the Pavilion, Southend Road, Filton, Bristol, every other Tuesday. Darryl Collins, 60 Mackie Rd, Filton, Bristol BS12 7NA, 0272 792982.

Bristol Format 40/80 Disc Club, for BBC disk users. Contact Peter Hughes, Format 40/80 Disc Club, c/o The Lending Library, Five Marshal Street, Bristol BS1 4AA.

Multi-User Club Valerie Boyde-Shaw, Nailsea 851337.

Worle Computer Club. Meets at Woodsprings Inn Functions Rooms on alternate Mondays at 7-10.30pm. H Bennett, 0934 514902 or F Feeney, 0934 833122.

BEDFORDSHIRE

Bedford Amateur Computer Club. Meets at Star Rowing Club, Bedford, on the first and third Tuesday of month 8pm. Rowan Bird, 74 High Street, Great Barford, MK44 3LB, 0234 870763.

Chiltern Computer Club. Meets at Five Bells, Eaton Bray, Near Dunstable, Leighton Buzzard on second and fourth Monday of each month. Contact Steve Betts, 42 Wallace Road, Eaton Bray, OU6 2DF, 0525 220922.

Luton College Computer Club. John Rodger, 0582 3411.

Luton Computer Club. J P Fletcher, 1 Trowbridge Gardens, Luton, LU2 7JY, 0582 450687.

BERKSHIRE

Easthampstead Computer Club. Meets at Easthampstead Park School, Bracknell, on the first Wednesday in month at 8pm. Brian Poulton, 0344 84423.

BIRMINGHAM

Birmingham Amateur Computer Club. Meets at Free Church Hall, Land Lane, Marston Green, Birmingham on first and third Thursday of each month at 7.30pm. Contact Les Moore, Secretary, Wolverhampton 725340.

BUCKINGHAMSHIRE

Aylesbury Computer Club. Meets at Quarrendon Youth Club every Friday at 7.30pm and at Mandsville County Secondary School the first Thursday of each month at 7pm. Ken Knight, 22 Mount Street, Aylesbury, 0296 5181.

Chiltern Microcomputer Club. Meets at the Garden Centre, School Lane, Chalfont St Giles, on the first Wednesday of each month. Mrs W Tibbitts, Ellwood, Deanway, Chalfont St Giles. 024 07 4906.

Iver Computer Club. P A Seal, 1 Ormonde Flats, Church Road, Iver Heath, 0753 652792.

Iver Computer Society meets at Huntsmoor room, Iver Village Hall on the second and fourth Thursday every month at 7.30. John Haigh, 141 Leas Drive, Iver, SL0 9RP.

CAMBRIDGESHIRE

Cambridge Microcomputer Club, meets on the third Wednesday of month. Derek Tripp, 3 Spurgeons Avenue, Waterbeach. 0223 315662.

Peterborough Personal Computer Club meets at Crosfield Electronics Social Club, fortnightly on Mondays. Andrew Pike, 0733 44342 after 5pm.

CHESHIRE

Altrincham Computer Club. Meets at N. Cestrian Grammar School, Durham Road, Altrincham, fortnightly. Martin Hickling, 39 Barrington Road, Altrincham, WA14 1H2, 061 941 4547.

Brunel Computer Club. Meets at St Werburgh Community Centre on alternate Wednesdays at 7 to 10pm. Mr R Simpson, 4 The Coots, Stockwood.

Chester Computer Club. Contact W Collins, 37 Garden Lane, Chester, Cheshire.

Crewe Computer Users Club meets at Buffaloes Club, Earl Street, Crewe, on the third Thursday of each month at 8pm. Bram Knight, 0270 623375.

Holmes Chapel Micro Club meets at Leisure Centre, Holmes Chapel at 7.30 to 9.30pm on the first and third Tuesday of month. Margaret Baker, 1 Helton Close, Crewe. 0477 34238.

Kinder Peek Computer Club meets at Bew Mills School every Monday. John Eary, New Mills 43870.

Kettleshulme National Computer Buyer's Club. Send SAE to Barry Edwards, Laneside House, Paddock Lane, Kettleshulme, nr Stockport, Cheshire.

New Mills & District PCC meets at New Mills School, fortnightly on Fridays at 7 to 9.30pm. Mr G M Flanagan, 11 Sundown Close, New Mills, Stockport, SK12 3DH, 0663 44051.

Northwest Computer Club meets fortnightly. John Lightfoot, 13 Aston Drive, Frodsham, Warrington, WA6 7PU. 0728 31519.

Northwest Computer Club, weekly meetings. Tom Wyatt, 29 Summer Lane, Halton, Runcorn Cheshire WA7 5PG. Runcorn 77545.

Mid-Cheshire Computer Club meets at Winsford Library on the second Friday every month at 7.30pm. Simon Sadler, Winsford 53339.

Stockport Software Exchange Club. Send SAE to P Redford, 53 Cavendish Road, Hazel Grove, Stockport, Cheshire.

CLEVELAND

Cleveland Micro Club meets on the second and third Tuesday of each month, under 18s on second of month, over 21s on third Tuesday of month. J Telford, 13 Weston Crescent, Norton.

Stockton Amateur Computer Club meets at YMCA, Stockton, each alternate week at 7-9pm. Peter Cheshire, 60 Croft Road, Eaglescliffe, Stockton-on-Tees, TS16 0DY.

CORNWALL

Cornish Radio Amateur Club — Computing Section. Bob Reason, 24 Mitchell Road, Camborne.

Cornwall Area PAICC meets at the Penzance Micro Centre every Friday. S Zenith. Hayle 754845.

St Austell Computer Club and Computer Town meets at ECIP Labs, Penpewan Road, fortnightly on Mondays at 7.30pm. N G Day, 2 Cilendale Close, St Austell.

CUMBRIA

Ambleside Computer Club. Contact Jeremy Westerman, 8 Hill Top Road, Ambleside, Cumbria. Tel: Ambleside 2452.

DERBYSHIRE

Derby Micro Society meets at Littleover Church Hall, Sheperd Street, first and third Thursday of each month at 7pm. Frank Taylor, 0332 559334.

Glossop Computer Club. John Dearn, 2 Spinney Close, Glossop.

DEVON

Brixham Computer Users Club. Meets at Computer Systems (Torbay), Pump Street, Brixham, Saturdays at 2.30pm. Ian Chipperfield, 22 Brookdale Court, Brixham, Devon (Brixham 59224).

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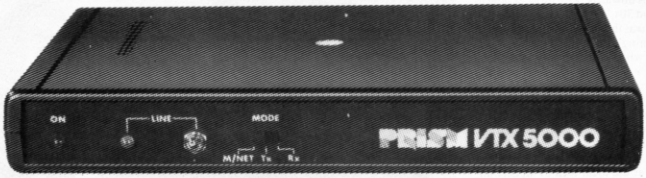

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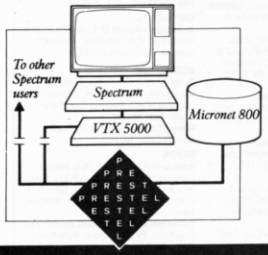

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ORPINGTON Ellis Marketing Ltd., 25 Station Sq., Petts Wood. TEL: 0689 39476

RAINHAM Microway Computers Ltd., 39 High St., Medway Towns. TEL: (0634) 376702

SEVENOAKS Ernest Fielder Computers, Dorset St. TEL: (0732) 456800

SITTINGBOURNE Computers Plus, 65 High St. TEL: 0795 25677

TUNBRIDGE WELLS Modata Computers Ltd., 28-30 St. Johns Rd. Tel. 0892 41566

LANCASHIRE

ACCRINGTON PV Computers, 38A Water St. TEL: (0254) 396371

BLACKBURN Tempo Computers, 9 Railway Rd. TEL: 0254 691333

BURNLEY IMO Computer Centre, 39-43 Standish St., BB11 1AP TEL: (0282) 54299

BURY (Lancs.) Micro-North, 7 Broad St. TEL: (061) 797 5764

OLDHAM Home & Business Computers Ltd., 54 Yorkshire St. TEL: (061) 633 1608

PRESTON Wilding's 49 Fishergate. TEL: (0772) 556250

ROCHDALE Home & Business Computers, 75 Yorkshire St. TEL: TBA

LEICESTERSHIRE

LEICESTER Youngs, 40/42 Belvoir St. TEL: (0533) 544774

MARKET HARBOROUGH Harborough Home Computers, 7 Church St. TEL: (0858) 63056

LINCOLNSHIRE

GRANTHAM Oakleaf Computers Ltd., 121 Dudley Rd. TEL: (0476) 76994/70281

LINCOLN MKD Computers, 24 Newlands. TEL: (0522) 25907

LONDON

E6 Percivals, 85 High St. North, East Ham. TEL: (01) 472 8941

E8 McGowans, 244 Graham Rd., Hackney. TEL: (01) 533 0935

EC2 Desk Computer Centre, 155 Moorgate. TEL: (01) 638 3339/1830

N14 Logic Sales, 19 The Broadway, The Bourne, Southgate. TEL. TBA (Opening Soon)

N20 Castlehurst Ltd., 1291 High Rd. TEL: (01) 446 2280

NW4 9A Vinci Computer Store, 112 Brent St., Hendon. TEL: (01) 202 2272/3/4 (Just Opening)

SE1 Vic Odden's, 6 London Bdg Walk. TEL: (01) 403 1988

SE9 Square-Deal, 375 Footscray Rd., New Eltham. TEL: (01) 859 1516

SE15 Castlehurst Ltd., 152 Rye Lane, Peckham. TEL: (01) 639 2205

SW6 Chelsea Micros Ltd., 14 Jerdan Place. TEL: (01) 385 8494

W1 Devron 4 Edgware Rd. TEL: (01) 724 3564

W1 Computers of Wigmore Street, 87 Wigmore St. TEL: (01) 486 0373

W1 Sonic Foto & Micro Center, 256 Tottenham Court Rd. TEL: (01) 580 5826

W3 Colormatic Computers, 44 High St., Acton. TEL: (01) 992 7611

W11 Electroleisure, 120 Notting Hill Gate. TEL: (01) 221 7029

MANCHESTER GREATER

MANCHESTER Lomax Ltd., 8 Exchange St., St. Ann's Sq. TEL: (061) 832 6167

SWINTON Mr. Micro Ltd., 69 Partington Lane. TEL: (061) 7282282

'Late Night Friday'

WYTH Fone, 213-215 Market St. TEL: (061) 366 5935

BOLTON Wilding Ltd., 23 Deansgate. TEL: (0204) 33512

WIGAN Wilding Ltd., 11 Mesnes St. TEL: (0942) 44362

MERSEYSIDE

HESWALL Thorngsard Computer Systems, 46 Pensby Rd. TEL: (051) 342 7516

LIVERPOOL Beaver Radio, 20-22 Whitechapel. TEL: (051) 709 9898

LIVERPOOL (Aintree) Hargreaves, 31/37 Warbreck Moor. TEL: (051) 525 1782

SOUTHPORT Central Computers, 575 Lord St. TEL: (0704) 31881

MIDDLESEX

EDGWARE Breaker 1-4, 130 High St. TEL: (01) 952 7488/8980

HARROW Camera Arts (Micro Computer Division, 24 St. Ann's Rd. TEL: (01) 427 5469

HAYES Chipshop, 1000 Uxbridge Rd. TEL: (01) 573 2511 (Just Opening)

TEDDINGTON Teddington Camera Centre, Broad St. TEL: (01) 977 4716

UXBRIDGE JKL Computers Ltd., 7 Windsor St. TEL: 0895 51815

NORFOLK

NORWICH Sound Marketing, 52 St. Benedicts St. TEL: (0603) 667725

THETFORD Thetford C & B Micros, 21 Guildhall St. TEL: (0842) 61645

NORTHANTS

NORTHAMPTON Basic Computers & Systems Ltd., 72 Kingsthorpe Hollow. TEL: (0604) 710740

NOTTINGHAMSHIRE

NOTTINGHAM Cameo Computers, 8/9/10 Trinity Walk. TEL: (0602) 742912

NOTTINGHAM Basic, 39-41 Trent Boulevard, West Bridgeford. TEL: (0602) 819713

NORTHERN IRELAND

BELFAST Arthur Hobson Ltd., 37 Gt. Victoria St. TEL: (0232) 246336

LONDONDERRY Foyle Computer Systems, 3 Bishop St. TEL: (0504) 268337

OXFORDSHIRE

ABINGDON Ivor Fields Computers, 21 Stert St. TEL: (0235) 21267

BANBURY Computer Plus, 2 Church Lane. TEL: (0295) 55890

HENLEY ON THAMES Family Computers Ltd., 40A Bell St. TEL: (049) 12 5744

OXFORD Ivor Fields, 7 St. Ebbes St. TEL: (0235) 21267

SCOTLAND

ABERDEEN North East Computers, 1-3 Ellis St., Peterhead. TEL: (0779) 79900

DUMFRIES Vennals, 71 English St. TEL: (0387) 4547

EDINBURGH The Silicon Centre, 6-7 Antigua St. TEL: (031) 557 4546

GLASGOW Victor Morris Ltd., 340 Argyle St. TEL: (041) 221 8958

HAMILTON Tom Dickson Computers, 8-12 Cadzow St. TEL: (0698) 283193

KILMARNOCK Vennals, 49 Foregate. TEL: (0563) 32175

KIRKCALDY Kirkcaldy Photographic Services, 254E High St., Fife. TEL: (0592) 204734

STIRLING R. Kilpatrick, 58 Port St. TEL: (0786) 5532

SHROPSHIRE

SHREWSBURY Computerama, 13 Castlegate. TEL: TBA

SOMERSET

TAUNTON Grays, 1 St. James St. TEL: (0823) 72986

STAFFORDSHIRE

STAFFORD, Computerama, 59 Forgate St. TEL: (0785) 41999

STOKE-ON-TRENT Computerama, 11 Market Sq., Arcade, Hanley. TEL: (0782) 268620

SUFFOLK

BURY ST. EDMUNDS Bury Computer Centre, 11 Guildhall St. TEL: (0284) 705772

FELIXSTOWE K. M. Communications Ltd., 4 Manning Rd. TEL: (0394) 271113 or 273459

IPSWICH Brainwave, 24 Crown St. TEL: (0473) 50965

LOWESTOFT John Wells, 44 London Rd., North. TEL: (0502) 3742

SURREY

CAMBERLEY Camera Arts (Micro Computer Division), 36 High St. TEL: (0276) 65848

CHERTSEY Chertsey Computer Centre, 1 Windsor St. TEL: (09328) 64663

CROYDON Cadcom Ltd., 96 Whitgift Centre (Next door to MacDonald's) TEL: (01) 686 8393

GUILDFORD The Model Shop, 23 Swan Lane. TEL: (0772) 503 39115

HASLEMERE Haslemere Computers, 25 Junction Place, adj. Rex Cinema. TEL: (0428) 54424

NEW MALDEN Surrey Micro Systems, 31 High St. TEL: (01) 942 0478

WALLINGTON Surrey Micro Systems Ltd., 53 Woodcote Rd. TEL: (01) 647 5636

WOKING Harpers, 71/73 Commercial Way. TEL: (04862) 25657

SUSSEX

BRIGHTON Capricorn, 1 Queens Rd. TEL: (0273) 29634

LITTLEHAMPTON Alan Chase Ltd., 39 High St. TEL: (09064) 5674/4545

TYNE & WEAR

NEWCASTLE-ON-TYNE Newcastle Camera & Computer Mart, 16 Northumberland Ct. TEL: (0632) 327461

WALES

ABERYSTWYTH AberData at Galloways, 23 Pier St. TEL. (0970) 615522

CARDIFF Randall Cox, 18/22 High St. Arcade. TEL: (0222) 21960

NEWPORT (Gwent) Randall Cox, 11B Commercial St. TEL: (0633) 67378

PEMBROKE Randall Cox, 19 Main St. TEL: (0646) 688 2876

PORT TALBOT Micro Gen, 6 Royal Buildings, Talbot Rd. TEL: (0639) 887730

WREXHAM T E Roberts, 25 King St. TEL: (0978) 364404/364527

WARWICKSHIRE

LEAMINGTON SPA IC Computers, 43 Russell St. TEL: (0926) 36244 (Opening Soon)

RUGBY The Rugby Micro Centre, 9-11 Regent St. TEL: (0788) 70622

WEST MIDLANDS

BIRMINGHAM Sherwoods, Gt. Western Arcade. TEL: (021) 236 7211

COVENTRY Coventry Micro Centre, 33 Far Gosford St. TEL: (0203) 58942

DUDLEY Computer World, 35 Churchill Precinct. TEL: 0384-238169

WEST BROMWICH Bell & Jones, 39 Queens Sq. TEL: (021) 553 0820

WORCESTER

WORCESTER David Waring Ltd., 1 Marmion House, High St. TEL: (0905) 27551

YORKSHIRE

BRADFORD Erricks Foto-Sonic House, Rawson Sq. TEL: (0274) 309266

HUDDERSFIELD Richards (formerly Lauries) 12 Queen St. TEL: (0484) 25334

HULL The Computer Centre (Humberside) Ltd., 28 Anlaby Rd. TEL: (0482) 26297

LEEDS Bass & Bligh, 4 Lower Briggate. TEL: (0532) 454451

SHEFFIELD Superior Systems Ltd., 178 West St. TEL: (0742) 755005

SKIPTON Look & See, 45 Belmont Bridge. TEL: 0756 60078

YORK York Computer Centre, 7 Stonegate Arcade. TEL: (0904) 641862

Exeter School, Magdalene Road, Exeter, on the second and fourth Tuesday every month. T G Holden, 14 Greenville Avenue, Teignmouth, TQ14 9NT.

Exeter & District Amateur Computer Club meets second Tuesday every month. Doug Bates, Fortescue House, Stoke Cannon, Exeter. Specialist meetings on third and fourth Tuesday.

Okehampton Computer Club. Contact Cherri Graebe, Okehampton 3523, or Okehampton Community College, Okehampton 3800. Meets 7pm each Monday during term time.

South Molton Computer Club. Meets at South Molton Tool Hire, Dootson House, Cooks Cross Industrial Estate, South Molton, North Devon, each Thursday at 7pm. Contact Nick Hews on 07695 3446.

Torbay Users Computer Club meets at Devon Computers, 39 Totnes Road, Paignton on Mondays fortnightly.

DORSET

Bournemouth Area Computer Club meets at Kinson Community Centre on the third Wednesday every month. Peter Hibbs, 54 Runnymede Avenue, Bournemouth, BH11 9SE. 0202 576547.

TOPIC meets at Canteen English Truck Centre on the second and fourth Wednesday every month at 7pm. David Washford, 1 Alexander Road, Bournemouth, BH6 5JA.

Purbeck Computer Club, contact 31 North Street, Wareham, Dorset BH20 1AD.

DURHAM

Darlington Computer Club, weekly meetings. L Boxell, 8 Vane Terrace, Darlington DL3 7AT. 0325 67766.

ESSEX

Genius Computer Club. 30 Webber House, North Street, Barking.

Great Dunmow Computer Club. Contact T Coombs, 4 Oakroyal House, Oakroyal Avenue, Great Dunmow, Essex CM6 1HQ.

Brentwood Amateur Computer Club, meets once a month. R Sadler, 18 Waresco st Road, Brentwood, CM15 9HD. Brentwood 232463.

Springfield Computer Club meets on the first Friday of every month. Stephen Cousines, 1 Aldeburgh Way, Springfield, Chelmsford, CM1 5PB. 0245 50155.

Canvey Computer Club. Contact Dean Williams, 17 Mornington Road, Canvey Island, Essex SS8 8AT.

Colchester Microprocessor Group meets at University of Essex on the second and fourth Wednesday of every month at 7.30pm. Information Centre, University of Essex, near Colchester.

Colchester Computer Society. Meets at Severalls Hospital Social Club, Colchester. Contact A Potten, 14 Foxmead, Rivenhall, Witham, Essex CM8 3HD, Witham 516335.

National Westminster Personal Computer Society, 412 Eastern Avenue, Gants Hill, Ilford. P J Moore, 01-554 9699.

Stanway School Computing Club, only school members at present. G Floyd, c/o Physics Department, Stanway School, Stanway, Colchester.

Woden 80 Computer Link Club, meets Wednesday evenings. Contact E Ferrant, 55 South Street, Barming, Kent, 0622 27885.

Nailsea Multi-User Club. Contact Valerie Boyde-Shaw, 0272 851337.

Romford Club, a new club. Mr D Norden, 138c Church Road, Romford.

Roundacre Micro Computer Users Club. Meets at the Roundacre Youth House, Laindon Link, Basildon every Wednesday at 7.30pm. Contact Mrs L Daden, Basildon 285119.

South East Essex Computer Society meets at Hockey Club at Roots Hall, near Southend Football Stadium on Wednesday at 7.30pm. Robin Knight, 128 Little Wakering Road, Little Wakering, Southend-on-Sea. 0702 218456.

GLOUCESTERSHIRE

British Amateur Electronics Club. Mr J Margetts, 3 Bishopstone Close, Golden Valley, Cheltenham.

Cheltenham Amateur Computer Club meets on the third Tuesday of each month at 7.30pm. Mike Pullin 0242 25617.

GCHQ, D W Adam, 16 Court Road, Prestbury, Cheltenham.

Cheltenham Amateur Computer Club meets at Prestbury Scout Headquarters, on the third Tuesday of every month at 7.30pm. M Hughes, 36 Riverviews Way, Cheltenham.

HAMPSHIRE

Commodore Computer Club. Meets on the first Friday of every month at Bury House, Bury Road, Gosport at 7.30pm. Brian Cox. Fareham 280530.

Fareham and Portsmouth Amateur Computer Club. Alan Smith, c/o Francis Close, Lee-on-the-Solent, Gosport, Hants PO13 8HB. 0705 550907.

RAF Odiham Computer Club. Contact c/o Officer i/c, Royal Air Force, Odiham, Nr Basingstoke, Hants.

Southampton Amateur Computer Club meets at Crestwood Centre, Shakespeare Road, Boyatt Wood, Eastleigh, Hants. on the second Wednesday of every month at 7.30pm. Paul Blitz. Chandlers Ford 69050.

HEREFORD

Hereford Amateur Computer Club, proposed new club. Stuart Edinborough, 2 Warwick Walk, Bobbiestock, HR4 9TG. 0432 269700.

HUMBERSIDE

Bridlington Microcomputer Club. Meets 7.30pm alternate Fridays at Old Star Inn, High Street, Bridlington. Contact D Compleman, 0262-601859.

Grimsby Computer Club meets at Grimsby Central Library fortnightly on Mondays at 7.30pm. Jenson Lee, 29 Park View, Cleethorpes. 0472 42559.

Scunthorpe & District Microprocessor Society meets at Community Centre, Lindun Street, Scunthorpe, every Tuesday at 7.30pm. G Hinch, 21 Old Crosby, Scunthorpe, South Humberside DN15 8PU.

KENT

Canterbury ACC proposed new club. Contact L Fisher, 21 Manwood Avenue, St Stephens, Canterbury, CT2 7AH.

Gravesend Computer Club. Meets at School Room Extra Tuition Centre, 39 The Terrace, Gravesend. Contact c/o The Extra Tuition Centre, 0474 50677.

Medway Amateur Computer & Robotics Organisation. Meets at 7.30pm on first Tuesday and third Wednesday of every month. Annual subs £5. Contact Paul Cameron, Unit 3, Walderslade Centre, Walderslade Road, Chatham, Kent, 0634-63036.

North Kent Amateur Computer Club meets at Lecture Theatre, Charles Darwin School, Jail Lane, Biggin Hill, on the first Thursday of every month at 7.30pm. Iain House, 28 Canadian Avenue, Catford SE6 3AS. 01-690 5441.

Orpington Computer Club meets at The Large Hall, Christ Church, Chaterhouse Road, Orpington, every Friday at 8pm-10.30pm. Mr R Pyatt, 23 Arundel Drive, Orpington, Kent BR6 9JF. Orpington 20281.

National Personal Computer User Association. Eric Keeley, 11 Spratting Street, Manston, Ramsgate, Kent.

Sevenoaks School Computer Club. G Sommerhoff, Technical Centre, Sevenoaks School, Sevenoaks, Kent. 0732 452340.

Tonbridge & Tunbridge Wells ACC. Ray Szatkowski, 1 Cromer Street, Tonbridge. 0732 355960.

LANCASHIRE

Blackburn Micro Computer Club. Roger Longworth, 12 Sharp Close, Accrington.

Bolton Computer Club meets at E4/24 Bolton Institute of Higher Education, Deane Road, Bolton, on Thursdays. David Atherton, 16 Douglas Street, Asherton, Manchester M29 9FB. 0942 876210.

Burnley Computer Club. Meets at Burnley Technical College on Tuesdays, 7.30-11pm. Contact Clive Tallon, 27 Basnett Street, Burnley, Lancs.

Chorley Computer Club meets at Townley Arms, Chorley, every other Tuesday at 8pm. Tony Higson, 23 Brock Road, Chorley, Lancs. Chorley 68429.

Ribble Valley Computer Club meets at Staff Canteen, Pendle Carpets Ltd, West Bradford, on the second and fourth Monday of month at 7-9pm. Contact Ian Thornton-Bryar, 25 Southfield Drive, West Bradford, Clitheroe, BB7 4TU.

Lancaster & Morecambe Computer Club. Sarah Blackler. 0524 33553.

South Chadderton Computer Club meets at Turf Lane Centre, Turf Lane, Chadderton, on Thursdays at 7-9.30pm. David Sholes, 18 Beech Avenue, Oldham, Lancs.

LEICESTERSHIRE

East Leake Computer Club. Andrew Jones, 59 Bateman Road, East Leake, Loughborough, LE12 6NN.

Hawker Siddeley Computer Club. Contact R Wrathall, 6 Naseby Drive, Loughborough LE11 0WU

LINCOLNSHIRE

Lincoln Computer Club, meets at The Cardinal's Hat, 238 High Street, Lincoln (entrance on Grantham Street) on first and third Wednesday of each month, except August. Contact Jeffrey Joy, 23 Cross O'Cliff Hill, Lincoln, 0522 28252.

Skegness Computer Club, meets at County Hotel every other Monday, 7.30-9.30pm. Reg Potter, 118 Beresford Avenue, Skegness. 0754 3594.

LONDON

Association of Computer Clubs. Contact Rupert Steele, 17 Lawrie Park Crescent, London SE26, 01-778 6824. National Club.

Croydon Microcomputer Club. Meets at Croydon Central Reference Library. Contact Vernon Gifford, 01-653 3207.

East London Amateur Computer Club meets at Harrow Green Library, Cathall Road, E11, on the second and fourth Tuesday of month at 7-10pm. Fred Linger on 01-554 3288.

Forum-80 London. Leon Jay, 01-286 6207.

Forum-80 Wembley. Victor Saleh, 01-902 2546.

Harrow Computer Group meets at Harrow College of Higher Education, Room W24, Northwick Park, on alternate Wednesday at 7pm. Bazyle Butcher, 01-950 7068.

Imperial College Microcomputer Club meets at room 145, level 1, on Tuesdays at 7.30pm. Tim Panton, c/o I.C. Union Office, Prince Consort Road, London SW7 2BB.

London School Computer Club. Burlington Danes School, Dane Building, DuCane Road, Hammersmith.

Metropolitan Police Amateur Computing Club meets on the first Thursday of month at 7pm. S Farley, 01-725 2428.

68 Microgroup meets at Regents Park Library, Robert Street, NW1, on the third Tuesday of month at 7.30pm. Jim Anderson, 41 Pebworth Road, Harrow, Middlesex.

North London Computer Club meets at the Polytechnic of North London, Holloway, N7 8DB, on Monday, Tuesday, Wednesday and Thursday during term time and one evening a week during holidays. Robin Bradbeer, 01-607 2789.

Paddington Computer Club meets at Paddington College, 25 Paddington Green, W2 1NB. Peter Hill, 01-723 5762.

Post Office HQ Microcomputer Club meets at room B145, River Plate House, 12-13 South Place, off Moorgate, on the second Thursday of month. Vernon Quaintance, British Telecom Enterprises, Cheapside House, 138 Cheapside EC2U 6JH. 01-726 4716.

Queens Crescent Computer Club. Meets at Queens Crescent Library, 165 Queens Crescent, London NW5, 01-485 4551.

The SOBAT Computer Club meets once a fortnight. Mr T Kayani, 12 Calderon Road, London E11.

South East London Microcomputer Club meets at Thames Polytechnic, Greens Ends, Woolwich SE18, on alternate Wednesdays at 7pm. Peter Phillipps, 61 Graigerne Road, SE3. 01-853 5829.

Southgate Microcomputer Club meets at Room B106 Southgate Tech, fortnightly on Thursdays at 7.30pm. Kevin Pretorius 01-882 2282. See Prestel page 25820645.

West London Personal Computer Club meets at Back room, Fox & Goose pub, Hanger Lane, Alperton, on the first Tuesday of month at 7.45pm. Graham Brain, 01-997 8986.

MANCHESTER

Manchester Computer Club meets at the Department of Computer Science, Manchester University, Oxford Road, on the first and third Thursday of month at 7.30pm. David Wade, 061-941 2486.

Small Business Computer Users Club. Proposed new club to meet the last Tuesday of month. K Wadsworth, 061-740 7232 after 5pm.

South Trafford Microcomputer Club. Meets fortnightly. Contact Ian White, 16 Leicester Avenue, Timperley, Altrincham WA15 6HR, 061-969 2080.

MERSEYSIDE

Merseyside Microcomputer Group meets at Merchant Taylor's School, Crosby, on second Thursday month. Mr F Shaw, 14 Albany Avenue, Eccleston Park, Prescot. 051-426 5536.

Southport Computer Club meets weekly. Ian Bristone, 28 Weld Road, Southport, Merseyside PR8 2DL. 0704 64524.

Wirral Microcomputer Users Group meets at Birkenhead Technical College every Monday. J Phillips, 14 Helton Close, Birkenhead, Merseyside L43 9JP.

Wirral Computer Club. Contact Gary Metcalfe, 24 Marlston Avenue, Irby, Merseyside.

MIDDLESEX

Brigadier Computer Club. Meets on the first and third Monday of every month at Brigadier Youth Centre, Brigadier Hill, Enfield at 7.30 pm. Subs: £2. Contact Steve Ward, 28 Brodie Road, Enfield, Middx EN2 0EU, 01-363 3786.

Micromodeller User Association. Meets three times a year. Contact Philip Matthews, Philip Morris House, 21 High Street, Feltham TW13 4AD, 01-751 6388.

Sunbury Computer Club meets at St Benedicts Hall, Napier Road, Ashford, on the last Tuesday of month at 8pm. Simon Taylor, 8 Priory Close, Sunbury-on-Thames, Middlesex. Simon Clark, 83 Watling Street, Towcester, Northants NW12 7AG.

ZX Micro Club. Contact Paul Hargreaves, 10 The Ride, Brentford, Middx.

NORTHAMPTONSHIRE

Corby Universal Micro Club. Meets at Lodge Park Sports Centre fortnightly on alternate Wednesdays and Thursdays. Contact Peter Wilson, 26 North Cape Walk, Corby, tel: Great Oakley 742622.

Kettering Microcomputer Club. Meets every Wednesday at 7pm. Details from Stephen Bickle on 0536 514381.

South Northants Computer Group meets at Anchor House, Moat Lane, Towcester, on Wednesdays at 7.30pm.

NOTTINGHAMSHIRE

Ashfield Computer Club meets at Carsic Junior School, St Mary's Road, Sutton in Ashfield on the first and third Thursday month. Derick Daines, c/o Cuttings Avenue, Sutton in Ashfield, Notts.

Eastwood Town Micro Computer Club meets at Devonshire Drive Junior School Wednesday at 5.45pm. Ted Ryan, 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

Nottingham Microcomputer Club meets at Castle Gate Centre, Nottingham, Monday at 7.30pm. Mr E Harvey, 68 Roseleigh Avenue, Nottingham NG3 6FH. Nottingham 608491.

Worksop Computer Group. Mr Andrews, Worksop 487327.

NORFOLK

Anglia Computer User Group. Jan Rejzl, 128 Templemere, Sprowton Road, Norwich. 0603-29652.
Brecklands Computer Club. Contact Andrew Hiom, 11 Annafewes Close, Thetford, Norfolk. Meets each Saturday, 5pm at this address.
Dereham & District Computer Club. Meets at Middle School, Westfield Road, Toftwood, East Dereham on every second Wednesday at 7.30pm. Contact Mrs Fran Cook, Dereham 67732.
East Anglian Computer User's Group meets at Crome Community Centre, Telegraph Lane, Norwich. Gill Rizi, 88 St Benedicts, Norwich.
Yarmouth Computer Club meets each Friday at 7pm. Contact the club at Unit 26, Longs Estate, Englands Lane, Gorleston, Great Yarmouth, Norfolk, 0983 662871.

OXFORDSHIRE

Association of Computer Clubs. Rupert Steele, St John's College, Oxford OX1 3JP.
Microsec meets at Clarendon Lab, Parks Road, Oxford, every week during term. Rupert Steele, St John's College, Oxford OX1 3JP.
Oxford Personal Computer Club. Len Phelps, Southport Cottage, Sutton Courtenay, Nr Abingdon, Oxon OX14 4AU.
Ridgeway Computing Club meets at Swan Hotel, East Ilsley, on the second Tuesday month. Mike Magney, Beavers, South Street, Blubury, Didcot, Oxon OX11 0JU.

SHROPSHIRE

Ludlow & District Microcomputer Club meets at Diocesan Education Centre, Lower Galdeford, Ludlow, on the second Monday of month at 7.30pm.
Shrewsbury Micro Club meets at Shrewsbury Shirehall once a month. Mr V Ives, 6 Bramley Close, Severn Meadows, Shrewsbury SY1 2TP.
Telford Computer Club meets at Telford ITEC on Monday 6-9pm. John Murphy, 10 Brichmore, Brookside, Telford TF3 1TF. 0952 595959.

SOMERSET

Sharp MZ80 Club, Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset.
Taunton Computer Club, meets 6pm on Tuesdays during term time at Somerset College of Arts and Technology. Contact David Elliott at Fir Tree House, Back Lane, Westbury-sub-Mendip, Wells, Somerset.
Yeovil Computer Club. D G Carrington, 2 Romsey Road, Yeovil, BA21 5XN.

STAFFORDSHIRE

Alsager Computer Club, meets at Alsager Comprehensive School, Stoke-on-Trent, Staffs, fortnightly on Tuesday. Rex Charlesworth, 09363 77270.
North Staffs Amateur Computer Club meets on the third Wednesday of each month. J Roll, 16 Hill Street, Hednesford, Staffordshire WS12 5DS.
ICL Birmingham Branch Micro Club, c/o WBA Ecclestone, 26 Browns Lane, Tamworth, Staffs.
Tame Valley Computer Club, Tim Marshall, 32 Milton Avenue, Leyfields, Tamworth, Staffordshire B79 8JG.

SUFFOLK

Haverhill Microcomputer Club, meets at St Marys' Church Hall, Camps Road, Haverhill, on the second, third and fourth Wednesday of month at 7.30 to 10pm. Andrew Holliman, 5 Trinity Close, Balsham, CB1 6DW, 022 029 583.
Newmarket Home Computer Group. Meets at Anchor House, Moat Lane, Towcester, at 7.30pm. Contact Simon Clark, 83 Watling Street, Towcester, Northants NN12 7AG, 0327 52191.
Suffolk Microcomputer Club meets monthly. Mr S Pratt, c/o Microtek, 15 Lower Brook Street, Ipswich.

SURREY

Ashtead Computer Club meets on the last Thursday of month. Contact P Palmer, 8 Corfe Close, Ashtead.
Deaf Microcomputer Users Group. Contact Chris Marsh, 3 Delaporte Close, Epsom, Surrey KT17 4AF.
Thames Valley Amateur Computer Club meets at Griffon, Caversham, on the first Tuesday of month. Brian Quarm, 25 Roundway, Camberley, GU15 1NR, Camberley 22186.
Ewell Micro Club, Dave De Silva, 316 Kingston Road, Ewell, KT19 0SU.
Farnham Computer Club, meets at Farnham 6th Form College, Morley Road, Farnham, on the second Wednesday of month. Adam Sharp, 14 Thorn Road, Boundstone, Farnham.
West Surrey Computer Club meets at Paddock Room, Green Man Public House, Burpham, Guildford, the first Thursday of month. Chris Karney, 0483 68121.
ITN Computer Club meets on Fridays. A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE. 0486 62035.
CBBS London meets on Sundays 4-10pm. P Goldman, PO Box 100a, Surbiton, KT5 8HY.
Richmond Computer Club meets at Richmond Community Centre, Sheen Road, on the second Monday of month at 8pm. Bob Forster, 18a The Barons St Margarets, Twickenham, Middlesex, 01-892 1873.
Sutton Library Computer Club meets at Central Library, St Nicholas Way, Surrey, on the first Friday of month at 6pm and second and third Tuesday of month. Dave Wilkins 01-642 3102.
Association of London Computer Clubs, Len Stuart, 89 Mayfair Avenue, Worcester Park, KT4 7SJ.

SUSSEX

Arun Microcomputer Club meets at Wick Amenity Centre, Wick Farm Road, Littlehampton, on the first Monday of month at 8pm, and third Sunday of month at 6pm. P Cherriman, 7 Talbot Road, Littlehampton, West Sussex DN17 7BL
Brighton, Hove & District Computer Club. Meets 7.30pm every second Wednesday at Southwick Community Centre. Contact J Smith, 30 Leicester Villas, Hove, E Sussex.
CVGC Video Games Club. Contact G Bond, 7 Swift Lane, Langley Green, Crawley Sussex.
Midhurst & District Computer User Group. Meets at the Grange Centre, Midhurst, at 7pm on the second and fourth Thursday of every month. Contact Val Weston, tel: Midhurst 3876.
Mid-Sussex Microcomputing Club. Contact Jeff Hayden, 2 Hillary Close, East Grinstead, RH19 3XQ.
West Sussex Microcomputer Club meets at Room RO6, Robinson Road Annexe, Crawley, on the first and third Monday of month. J Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, 0293-884207
Worthing & District Microcomputer Club meets at Rose Wilmot Youth Centre, Littlehampton Road, Worthing, on alternate Sundays 11am-1pm. B. Thomas, 11 Gannon Road, Worthing, W. Sussex, BN11 2DT, 0903 36785.

TYNE & WEAR

Newcastle upon Tyne Personal Computer Society meets at Room D103, Newcastle Polytechnic on the first Tuesday of every month. Pete Scargill, 21 Percy Park, Tynemouth, 0632 573905.

WEST MIDLANDS

Cannock Computer Society meets at Cannock Computer Systems, Old Penkridge Road, Cannock, fortnightly. Terry Sale, 20 Redwood Drive, Chase Terrace, Walsall WS7 8AS.
Coventry Computer Circle. Contact Chris Baugh, 9 Hillman House, Smithford Way, Coventry CV1 1FZ.
Coventry Micro Club meets on Wednesdays at 7.30pm at Walsgrave Junior School. Jack Hewitt, 3a Boswell Drive, Walsgrave-on-Sowe, Coventry, Tel: 615543.
Walsall Computer Club meets at Park Hall Community School on the second and fourth Monday month 6.45-9.45pm. Alison Hunt, 58 Princes Avenue, Walsall, WS1 2DH, 0922 23875.
West Midlands Amateur Computer Club meets at Enfield School, Love Lane, Stourbridge, on the second and fourth Tuesday of month. John Tracey, 100 Booth Close, Brierley Hill, Kingswinford, 0384 70097.

WILTSHIRE

Chippenham and Calne, proposed new club. Matthew Jones, Pinhills, Calne SN11 0LY.

WORCESTER

Worcester & District Computer Club meets at Old Pheasant Inn, New Street, Worcester, on the second Monday month at 8pm. D Stanton, 55 Vauxhall Street, Rainbow Hill, WR3 8PA.

YORKSHIRE

Barnsley Co-Operative Computer User Group meets at Co-Op Social Club, Pogmore, Barnsley, on the last Tuesday month at 7.30pm. James Bridson, c/o 39 Kereforth Hall Road, Barnsley, South Yorks S70 6NF. 0226 41753.
Greenhead Grammar School Computer Club. Brian Smith, Greenhead Road, Keighley, West Yorks BD20 6EB, 0535 62828.
Huddersfield Computer Club meets every Monday. Chris Townsend, 760/4 Manchester Road, Linthwaite, Huddersfield, 0484 657299.
Keighley Computer Club. Meets each Wednesday at 7.30pm at Methodist Church Hall, Market Street, Keighley, West Yorks. Contact Simon Midgley on 0535 681463.
Leeds Microcomputer Users Group meets at 8 Regent Street, Chapel Allerton, fortnightly on Thursday at 6pm. David Parsons, 22 Victoria Walk, Horsforth LS18 4PL.
Program Power, R Simpson, 5 Wemsley Road, Leeds LS7 2BX, 0532 683186.
Shipley College Computer Group meets on Tuesdays. Paul Channell, tel: 0274 595731.
South Yorkshire Personal Computer Group meets at General Lecture Theatre, St Georges Building, Mappin Street, Sheffield, on second Wednesday month at 7.30pm. Paul Sanderson, 8 Vernon Road, Tetley, Sheffield S17 3QE.
Thurnscoe & District Micro Users' Club meets at Thurnscoe Comprehensive School, Physics Lab, Clayton Lane, Thurnscoe, Wednesday at 7.30pm during school term. Mr James Davis, 62 Tudor Street, Thurnscoe East, 0709 893880.
West Yorkshire Microcomputer Group meets on Tuesdays. Phillip Clark, c/o Suite 204, Crown House, Armley Road, Leeds LS12 2ES, 0532 632532.
York Computer Club meets at the Enterprise Club every Monday at 8pm. K Thomas, Green Lea, Ripon Road, Harrogate, HG1 2BY, 0904 38239.

SCOTLAND

Bishopton Computer Club meets at 'Cwa Ben', Sachelcourt Avenue, Bishopton, Renfrewshire, on Sunday once a month Alasdair Law, 10 Dunglass Road, Bishopton, Renfrewshire PA7 5EF.
Edinburgh Home Computing Club meets at Claremont Hotel, Edinburgh, on the 2nd, 3rd and 4th Wednesday of month. I. Robertson, 031 441 2361.
Scottish Amateur Computer Society, Mike Anthony, 46 Moredun Park Gardens, Edinburgh EH17 7JR.
Central Scotland Computer Club meets at Falkirk College of Technology, Grangemouth Road, Falkirk, on the first and third Thursday of month. James Lyon, 78 Slamannan Road, Falkirk FK1 5NF.
Fife Computer Users Club meets fortnightly. Murray Simpson, 31 Tom Steward Lane, St Andrews, Fife, KY16 8YB.
Grampian Amateur Computer Society meets at 35 Thistle Lane, Aberdeen, on the second and fourth Monday every month at 7.30pm. Alan Morrison, 21 Beech Road, Westhill, Skene, Aberdeenshire AB3 6WR.
Kemnay Computer Club meets weekly. S Stubbs, 15 The Glebe, Kemnay, Inverurie, Aberdeenshire.
Inverness Personal Computing Club meets every second Tuesday at 7.30pm. Gyl Mackenzie, 38 Ardconnel Street, Inverness IV2 3EX. 0463 220922.
Perth & District Amateur Computer Society meets at Hunters Lodge Motel, Bankfoot, on the third Tuesday of month at 7.30pm. Alastair McPherson, 154 Oakbank Road, Perth PH1 1HA.
Skye and Lochalsh Computing Society. Contact C Manvell, Tigh na Pairc, 25 Lower Breakish, Isle of Skye IV42 8QA, 04712 317.
Strathclyde Computer Club meets at Wolfson Centre, 106 Rottenrow, Glasgow, on the third Wednesday of month. B Duffy, 24 Lomand Drive, Condorrat, Cumbernauld G4 8NW.

WALES

Abergele Computer Club meets at Abergele CI Offices every Thursday at 7.30-10pm. W Jones, 77 Millbank Road, Rhyl, Clwyd.
Clwyd '80 Computer Club. Contact Allan Jones, The Island, 1 High Street, Connah's Quay, Deeside, Clwyd, 0244 816893. Meets at Deeside Community Centre, Queensferry, Deeside on Thursday at 7pm.
Colwyn Computer club meets at the Greens Hotel, Colwyn Bay, at 7pm. Contact D Bevan, c/o Abergele Road, Colwyn Bay, Clwyd LL29 7PA.
Connah's Quay Computer Club. Meets second and fourth Thursday of each month at the Community Centre, Cable Street, Connah's Quay, at 7pm. Contact G Johnson, tel Deeside 821945.
Gwent Amateur Computer Club meets at St Mary's Institute, Stow Hill, Thursday at 7.30pm. Rothery Harris, 16 Alanbrook Avenue, Newport, Gwent, Wales NPT 6QJ.
Llantwit Major Computer Club. Meets at Adult Education Centre, Llantwit Major, every Tuesday. Contact Douglas Mountain, 16 Denbigh Drive, Llantwit Major, South Glamorgan CF6 9GQ.
Mold Computer Club. Meets 7.30pm on first and third Thursday of each month at the Daniel Owen Centre, Earl Street, Mold. Contact G Johnson, 18 Daytona Drive, Northop Hall, Mold, Clwyd, Wales. Tel Deeside 821945.
Milford Central Computer Club. Open to schoolchildren, meets every lunch hour and evening. Contact Harry Evans, Milford Central School, Priorsville, Milford Haven, Dyfed, 043 784 571.
Pencoed Amateur Computer Club meets fortnightly on Saturdays at Pencoed Welfare Hall. Philip Williams, 38 Bryn Rhedyn, Pencoed, Bridgend, Mid-Glamorgan CF35 6TL, 0656 860307.
Pontypool Computer Club meets at The Settlement, Roackhill Road, Pontypool, Gwent, on Friday. Graham Loveridge, on Pontypool 2827.
Swansea & Southwest Wales Amateur Computer Club meets on the last Friday every month. Paul Griffiths, 1 Prescelli Road, Penlan, Swansea SA5 8AF.
Swansea Computer Club. Meets at No 10 (pub), Union Street every Tuesday at 7.30pm. Contact Robert Palmer, 044 123 602.
Wrexham & District Computer Club. Meets each Thursday. Contact Mike Houghton, 1 Snerwell Avenue, Wrexham, Clwyd, Wales.

NORTHERN IRELAND

North Down Micro Users Club. Meets at Bangor Central Library, Hamilton Road, every fourth Monday. Contact A Robson, 0247 67060.

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- SASI Industry standard Winchester hard-disk interface (optional extra)

Memory
- RAM 128K (Cache utilises 64K)
- EPROM 4K
- 60K TPA
- 192K RAM board (optional extra)

Storage
- 2 Intelligent 5¼" Floppy disk drives, 500 Kb (unformatted), 400Kb (formatted) each, single side quad-density.

Ports
- Parallel: Centronics type
- Serial: Two RS232C
  RS422 (optional extra)

Screen
- 10" Green phosphor, 80 x 25 display, Brightness control and inverse video

Keyboard
- Slimline and fully detachable
- 86 keys (107 legends) full QWERTY
- Separate numeric pad
- Separate (10) programmable keys
- Coiled lead for easy and neat storage

Dimensions
- Height 220mm (8.7")
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- ProfitPlan "Calc" Spreadsheet
- MicroModeller Advanced Business Planner
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DATABASICS

This week PCN Databasics lists a selection of add-ons for your micro. PCN keeps you up to date in three-week cycles, listing peripherals, then software, followed by micros.

Printers are best categorised by print-head type. The two most common methods of transferring type to paper are the **Dot matrix** and **Daisywheel** techniques.

A dot matrix printer uses a row of pins which are programmed to strike the paper through a ribbon and form the character as a pattern of dots.

The daisywheel acts more like a conventional typewriter, the character set being pre-formed on a wheel with each character on a separate spoke. As the interchangeable wheel rotates it is struck by a hammer to form the character impression.

Dot matrix printers tend to be faster than daisywheel but offer lower print quality.

In selecting a printer make sure the **interface** on your computer is compatible with those available as standard or at extra cost on the printer.

The ● sign means the interface is included in the price; O means you have a choice of interfaces included in the price; + means the interface will cost extra.

Max Baud rate indicates the approximate characters-per-second rate as they are fed into the printer.

The **buffer** stores characters sent by the computer. The printer can take characters in chunks, at a rate quicker than they are able to be printed, sometimes allowing the computer to be freed for further use.

Lines per inch indicates the maximum number of lines printed in a vertical inch. **Characters per inch** can be varied on some printers as the typesizes themselves can be adjusted.

Maximum print speed as indicated by the manufacturer tends to be a little optimistic. **Maximum print positions** tells you the optimum number of characters that can be printed in one line by the smallest character size on the printer. **Maximum paper width** is the widest paper the printer can take.

Size represents the space the printer takes up on a desk top. **The weight** of the printer is given in kilogrammes.

Maximum copies indicates the number of carbon copies that can realistically be produced at one time.

Underlining puts a line under characters while **bold type** thickens the characters to make them stand out. **True descenders** indicates that the print method allows for fully formed tails on letters such as p,g or q.

Proportional spacing puts the same space between characters whether they are a long 'm' or a short 'i'. **Block graphics** builds up pictures using rectangular blocks, while **High Resolution Graphics** uses smaller dots.

Bidirectional means the printer can save time by printing left to right and then doing the next line backwards right to left. Similarly, **Logic Seeking** enables the machine to save more time by printing the short lines without sweeping over the whole width of the page.

Feed methods comprise **fanfold** which uses continuous stationery sheets folded road-map style drawn into the printer by a tractor mechanism. The tractor cog fits into holes in the fanfold paper and takes the paper past the printer mechanism. **Roll** is a roll of paper that feeds into the printer, usually using **friction feed** where the paper is gripped between two rollers, typewriter-style. **Cut sheet** indicates the printer uses single sheets like a typewriter.

Distributor: to find which company distributes a particular add-on, use the code listed in this column to refer to the distributor table.

The table is at the end of the listings, and gives the distributor's name and telephone number.

PERIPHERALS

PRINTERS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)					Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi-Directional	Logic Seeking	Feed Method					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
Adler TRD 170	£833	Daisywheel		●		●		9600	256	6,8	10,12,15	17	198	15.5	56×37	13	6	●	●	●	●			●	●	●	●	●	●	●	T2
Anadex DP 9000A	£1,397	M 7×9, 9×9		●	●	●		9600	2700	6,8	10,12.5,15,16.7	200	106	9.5	40.9×57	13.6	6	●	●	●				●	●	●	●			●	I1
Anadex DP 9001A	£1,397	M 7×9, 11×9		●	●	●		9600	2700	6,8	10,12.5,15,16.7	200	132	9.5	40.9×57	13.6	6	●	●	●				●	●	●	●			●	I1
Anadex DP 9500	£1,397	M 9×9		●	●	●		9600	700	6,8	10,12,13.3	200	176	15.5	39×59.9	16	6	●	●	●				●	●	●	●			●	I1
Anadex DP 9500A	£1,397	M 7×9, 9×9, 13×9		●	●	●		9600	2700	6,8	10,12,13.3	200	176	15.5	40.9×70.3	16	6	●	●	●				●	●	●	●			●	I1
Anadex DP 9500L	£1,295	M 7×9, 9×9		●	●	●		9600	700	6,8	10	150	132	15.5	39×59.9	16	6			●				●	●	●	●			●	I1
Anadex DP 9501	£1,397	M 7×9, 11×9		●	●	●		9600	700	6,8	10,12.5,15,16.7	200	220	15.5	39×59.9	16	6	●	●	●				●	●	●	●			●	I1
Anadex DP 9501A	£1,397	M 7×9, 11×9		●	●	●		9600	2700	6,8	10,12.5,15,16.7	200	220	15.5	40.9×70.3	16	6	●	●	●				●	●	●	●			●	I1
Anadex DP 9620A	£1,489	M 7×9, 9×9, 13×9		●		●		9600	1500	6,8	10,12,15,16.4	200	216	15.5	40.9×70.3	16	6	●	●	●				●	●	●	●			●	I1
Anadex WP 6000	£2,616	M up to 18×20		●		●		19200	4500	6,8,12,16	10,12,16.7	285	220	15.5	46.7×74.9	25	6	●	●	●	●	●	●	●	●	●		●	●	●	I1
ASP 3500	£977	M 9×7, 9×9		○		○		9600	80	6,8	10,12,16.5	180	217	14	61.5×40.5	19	6	●	●	●		●	●	●	●	●					M1
Brother HRI	£747	Daisywheel		○		○	○	9600	2000	4,5,6	10,12,15	35	198	16.5	38.1×71.2	16	8			●				●	●	●			●		J1
Canon AP400	£1,140	Daisywheel	●			●	1	19200	4000	4,6,8	10,12,15	25	197	15.5	50.8×48.2	18.5	6	●	●	●	●	●		●	●	●	●	●	●	●	D1
Centronics 159/4	£962	M 9×7				●		9600	768	6	5,8.18,10,16.36	150	80	10	38×35.6	10	5							●	●	●			●	●	B1
Centronics 150/4	£682	M 9×7				●	1	9600	768	6,8	10,12,16.36	150	132	9.5	38.1×35.5	9.1	3	●		●	●			●	●	●			●	●	R1
Centronics 152/4	£788	M 9×7				●	1	9600	708	6,8	10,12,16.5	150	217	9.5	38.1×35.5	9.1	3	●		●	●			●	●	●			●	●	R1

Centronics 154	£869	M 11×8		●		●		9600	2000	6,9,12,18	5,10,16.5	120	132	15	52.6×37.1	13	5	●		●			●	●	●	●			●		C1
Centronics 159/2	£881	M 9×7		●				N/A	768	6	5,8.18,10,16.36	150	132	10	38.1×35.6	10	5						●	●	●		●	●	●		B1
Centronics 351	£1,891	M 7×9		●	+	●		19200	2000	6,8	5,6,8.25,10,12,16.5	200	192	15	45.7×55.9	18	6	●	●	●		●	●	●	●	●	●	●	●		B1
Centronics 352	£1,966	M 7×8		●	+	●		19200	2000	6,8	5,6,7,5,8.25,13,2.15,16.5	200	218	14.5	55.9×45.7	18.1	6	●					●	●	●	●	●	●	●		C1
Centronics 353	£2,420	M 7×8			+	●		19200	4000	3,4,6,8,12	10,12,13.2,15,16.5	200	218	15	55.9×45.7	18.1	6	●		●			●	●	●	●	●	●	●		C1
Centronics 739/2	£710	M 11×9		●				2200	132	6	5,8.3,10,16.7	100	132	9	36.8×27.9	5.4	5	●			●		●		●	●			●		C1
Centronics 739/4	£786	M 11×9				●		9600	512	6	5,8.3,10,16.7	100	132	9	36.8×40.6	7.2	5	●					●			●	●	●			C1
Commodore 4022P	£454	M 6×7	●					N/A	N/A	2	5,10	40	80	10	36.8×33	9.9	3						●	●	●	●	●	●	●			C2
Commodore 8023	£1,029	M 5×8	●					N/A	N/A	2	5,10	150	250	15	51.4×36.8	11.6	3		●				●	●	●	●	●	●	●			C2
Data Products DP55	£1,687	Daisywheel				●	2	9600	1000	6,8	10,12,15	55	198	15	44.4×60.4	24	6	●	●	●	●		●	●	●	●	●	●		●	S1
Data Products M100	£1,790	M 9×9		+		+	1	N/A	N/A	6,8	5,8,10,16.5	140	218	16	67.5×59.4	27	6	●	●	●	●	●	●	●	●				●			S1
Data Products M120	£1,741	M 7×7		+		+	1	N/A	N/A	6,8	5,10,16.7	180	220	16	67.5×59.4	27	6							●	●	●			●			S1
Data Products M200	£1,979	M 7×7		+		+	1	N/A	N/A	6,8	5,10.8,16.7	340	340	16	67.5×59.4	27	6							●	●	●			●			S1
Data South DS180	£1,604	M 9×7	+	●	+	●	1	9600	2000	6,8	5,6,8.25,10,12,16.5	180	217	15.5	60.9×40.6	16	6	●	●	●		●	●	●	●	●			●			D2
Diablo SP1/P11	£2,127	Daisywheel				●		9600	256	6,8	10,15	40	198	16	56.9×46.3	27.2	6	●	●	●	●			●	●			●		●		M2
Diablo 630	£2,127	Daisywheel				●		9600	768	6,8,12	10,12,15	40	198	16.5	56.9×46.3	27	6	●	●	●	●			●	●				●	●		M2
DMP 100	£249	M 5×7		●		●		1200	2000	6,8	10.5	50	80	9.5	40.6×20.9	3.9	1	●	●	●		●	●		●	●			●	●		T1
DMP 200	£499	M 9×23		●		●		1200	2000	6,8	10	120	120	9.5	41.9×34.3	7.5	3	●	●	●	●	●	●	●	●	●	●		●	●		T1
DMP 400	£699	M 7×9, 9×9		●		●		1200	2000	6,8	10,12,16.7	140	220	15	61.9×40.4	19	5	●	●	●	●	●	●	●	●	●		●	●			T1
DMP 500	£1,099	M 23×9		●				9600	2000	6,8	10,12,16.7	220	220	15	58.4×33	12.7	5	●	●	●	●	●	●	●	●	●		●	●			T1
DMP 2100	£1,399	M		●		●		1200	2000	6,8,12	10,12,16.6	160	232	15	55.2×38.1	20	8	●	●	●	●	●	●	●	●	●			●			T1
DRE 8820	£895	M 9×7		○		○		9600	500	6,8	10,12.5,15,16.7	150	266	15.5	64.7×47.6	23	5	●			●				●	●	●		●	●		G1
DRE 8830	£1,300	M 9×7		○		○		9600	500	6,8	10,12,13.3,15,17	180	226	15.5	64.7×47.6	23	5	●			●				●	●	●		●	●		G1
DRE 8840	£1,370	M 9×7		○		○		9600	500	6,8	10,12,13.3,15,17	240	226	15.5	64.7×47.6	23	5	●			●				●	●	●		●	●		G1
DRE 8910	£1,585	M 9×7, 9×11		○		○		9600	500	6,8	10,12,13.3,15,17	160	226	15.5	64.7×47.6	23	5	●			●				●	●	●		●	●		G1
DRE 8925	£1,660	M 12×8, 12×20		○		○		9600	500	6,8	10,12,15,16.7	120	226	15.5	64.7×47.6	23	5	●			●				●	●	●		●	●		G1
DRH 80	£621	M 7×9		○		○		9600	256	6,8	10,12.5,15,17.5	80	140	8	41.5×30	7.5	4	●	●	●		●		●	●	●	●	●	●	●		T1
DRH 136	£776	M 7×9		○		○		9600	2000	6,8	10,12,15,16.5	120	224	15.5	48.6×30.3	10.5	3	●	●	●		●	●	●	●	●	●	●	●	●		T1
DRS 250	£1,431	M 7×9		○		○		19200	512	6,8	10,12,15	250	198	6	61×45	25	5	●	●	●		●	●	●	●	●			●			T1
DWP 410	£995	Daisywheel		●				9600	2000	6,8	10,12	25	160	16	60.3×19.6	16	5	●	●	●	●			●	●	●		●	●	●		T1
Epson MX80	£401	M 9×9		●	+	+	1	19200	256	6,8	5,8.25,10,16.5	80	132	10	40.6×38.1	5.5	3	●	●	●		●	●	●	●	●			●			E1
Epson MX80 FTT/3	£447	M 9×9		●	+	+	1	19200	256	6,8	5,8.25,10,16.5	80	132	10	40.6×38.1	7.7	3	●	●	●		●	●	●	●	●			●			E1
Epson MX82	£470	M 9×9		●	+	+	1	19200	256	8	17.2	80	159	10	40.6×38.1	7.7	3	●	●	●	●	●	●	●	●	●	●	●	●	●		E1
Epson MX100FT/3	£574	M		●	+	+	1	19200	256	8	16.5	100	233	15.5	59.7×40	10	3	●	●	●		●	●	●	●	●	●	●	●	●		E1
Facit 4510	£672	M 9×7		○	○	○		9600	712	6,8	6,12,16,17.5	100	132	11.5	42.5×34.8	9	5	●	●	●			●	●	●	●			●	●		A2
Facit 4525	£1,150	M 9×9		○	○	○		9600	512	6,8	5,8.5,10,17	280	132	11.5	46.5×35.6	13.5	5	●	●	●			●	●	●	●						A2
Facit 4542	£2,300	M 9×14		●	+	+		9600	800	6,8	10,12,15	250	232	18	64×45.7	40	5	●	●	●	●	●	●	●	●	●			●	●		A2
Fujitsu 830	£2,179	Daisywheel		+	●	●		1200	256	3,6,8	10,12,15	80	204	15	59.7×44.9	18	6	●	●	●	●			●	●	●		●	●	●		Z1
General Electric 2030	£961	M 9×7				+	1	1200	640	2,4,6,8,12	10,13,16.5	60	218	15.5	54.6×47.6	9.9	2	●							●	●	●		●	●		Z1
General Electric 2120	£1,751	M 9×7				+	1	1200	640	2,4,6,8,12	10,13,16.5	150	218	15.5	54.6×47.6	9.9	2	●							●	●	●		●	●		Z1
General Printer GP300	£2,287	M 9×9, 18×25				●	2	19200	380	6,8	10,12,15	300	120	13.5	52×44.5	20	5	●	●	●	●	●	●	●	●	●		●		●		I2
General Printer GP300L	£2,490	M 9×9, 18×25				●	2	19200	380	6,8	10,12,15	300	132	13.5	63.5×51.5	24	5	●	●	●	●	●	●	●	●	●		●		●		I2
Hermes 612C	£2,242	M 36× 18		●	+	●		9600	2000	6,8	10,12,15	200	198	15	426×620×180	22	6	●	●	●			●	●	●	●		●	●	●		M7
Integrex	£914	M 7×5, 9×6	+	●		+		N/A	37	6,8	10	125	80	10	38.7×32.5	9.6	1					●	●							●		D3
ITT Swift 3342	£1,719	M 9×7				○	○	1200	640	2,3,4,6,8,12	10,13,16.5	150	240	15.5	56×47	10.4	6	●							●	●	●		●	●		I3
ITT Swallow	£914	M 9×7			○	○	○	1200	640	2,4,6,8,12	10,13,16.5	60	240	15.5	56×47	10	6	●							●	●	●		●	●		I3
Juki 6100	£459	Daisywheel	+	●	+	+		2400	2000	6,8	10,12,15	18	165	13	454×520×151	14	4	●	●	●	●		●	●	●	0		●	0	●		M7
Lear Siegler	£1,667	M 9×9		○	○	○		19200	2000	6,8	10,12	180	218	16	68.6×50.2	22.7	5	●		●	●	●		●	●	●			●			I4
Logabax LX213	£1,840	M 9×9			+		●	9600	4000	6,8	10,12,16.5	180	218	15	57.1×43.2	17	5	●	●	●					●	●	●		●	●		T3
Logabax LX217	£2,242	M 9×9			+		●	9600	400	6,8	10,12,16.5	180	218	15	57.1×43.2	17	5	●	●	●					●	●	●		●	●		T3
Micro Peripherals 99G	£517	M 9×7, 11×9			●		●	9600	2048	6,8	10,12,16.5	100	136	9.5	41.1×27.3	6.7	2	●	●	●					●	●	●	●	●	●		T3
Micro Peripherals 150G	£918	M 9×7, 11×9			●		●	9600	8192	6,8	10,12,16.5	150	226	15	58.4×39.9	11.2	2	●	●	●					●	●	●		●	●		T3
MT120 I	£600	M 9×7	+	●	+	+		9600	132	6,8	10,12.5,16.6,20	160	132	10	34.3×24.1	7.5	4				●	●	●	●	●	●	●	●	●	●		M3
MT120 L	£765	M 9×7	+	●	+	+		9600	132	6,8	10,12.5,16.6,20	160	132	10	34.3×24.1	7.5	4		●	●		●	●	●	●	●	●	●	●	●		M3
MT1802 I	£1,845	M 7×9	+	○	+	○		9600	218	6,8	10,16.6	200	218	16	55.9×76.2	8.6	5				●				●	●	●			●		M3
MT1802 L	£2,205	M 7×9	+	○	+	○		9600	218	6,8	10,16.6	200	218	16	55.9×76.2	8.6	5				●				●	●	●			●		M3

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)					Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Feed Method								Distributor
			I-EEE	Centronics	20ma	RS232	Others ●											Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Tan Fold	Roll	Cut Sheet	Tractor	Frictional	
PRINTERS																														
MT440 I	£1,966	M 9×7		●	+	+		9600	220	3,4,6,8,12	10,12.5,16.6	400	220	16	66×45.7	36	5			●			●	●	●			●		M3
MT440 L	£2,185	M 9×7		●	+	+		9600	220	3,4,6,8,12	10,12.5,16.6,	400	220	16	66×45.7	36	5			●			●	●	●			●		M3
MT420 I	£882	M 9×7		●	+	+		9600	220	3,4,6,8,12	10,12.5,16.7	200	220	16	66×45.7	36	5		●	●	●		●	●	●			●		M3
MT420 L	£954	M 9×7		●	+	+		9600	220	3,4,6,8,12	10,12.5,16.7	200	220	16	66×45.7	36	5		●	●	●		●	●	●			●		M3
MT140 I	£1,593	M 9×7	+	●	+	+		9600	218	6,8	10,12.5,16.6,20	160	218	16	48.3×24.1	7.5	4		●	●		●	●	●	●		●	●	●	M3
MT140 L	£1,869	M 9×7	+	●	+	+		9600	218	6,8	10,12.5,16.6,20	160	218	16	48.3×24.1	7.5	4		●	●		●	●	●	●		●	●	●	M3
Newbury Labs 1550	£747	M 9×7		○		○		9600	2000	6,8	5,6,8,5,10,12,17	120	230	15.5	55.9×30.5	11	3	●	●	●	●	●	●	●	●				●	N1
Newbury Labs 8510A	£552	M 9×7		○		○		9600	3000	6,8	5,6,8,5,10,12,17	120	132	10	55.9×28.6	8.5	3	●	●	●	●	●	●	●	●				●	N1
Newbury Labs NL40	£1,478	Daisywheel		○	○	○		2400	2000	6,8	10,12	40	163	15.5	55.9×43.2	14	2	●	●	●	●		●	●	●	●	●	●	●	N1
OKI Microline 80	£242	M 5×7		●		+		9600	256	6,8	5,10,16.5	80	132	9.5	34.2×24.5	6.5	4					●			●	●		●	●	X1
OKI Microline 82A	£378	M 9×7		●	●	+		1200	132	6,8	5,8,3,10,16.5	120	132	9.5	36.1×32.8	8.9	4	●		●		●	●	●	●		●	●	●	X1
OKI Microline 83A	£608	M 9×7		●	●	+		1200	132	6,8	5,8,3,10,16.5	120	132	15	51×32.8	14	3	●		●		●	●	●	●		●	●	●	X1
OKI Microline 84	£948.75	M		○	○	●		4800	132	6,8	5,8,3,10,12,17	200	231	15	51×32.8	14	3	●	●	●	●		●	●	●		●	●	●	X1
Olivetti DM5050	£575	M 7×9		●	+	+	4	9600	1000	6	10,12.5,16.5	100	132	9	11.6×30	7.5	2	●	●	●			●	●	●		●	●		B2
Olivetti DM5100	£1,033	M 7×9	○	○	○	○		9600	256	6	10,12,16.5	140	220	14.75	59.2×40.1	17	4	●	●	●		●		●	●			●		B2
Olivetti DM5200	£1,351	M 7×9	●	+	+	+		9600	256	6	10,12,16.5	200	220	19.75	59.2×40.1	17	4	●	●	●		●		●	●			●		B2
Olivetti DY-211	£862	Daisywheel	+	●	+	●		9600	1000	6	10,12,15	29	198	17	54.1×32.8	16.3	4	●	●	●	●			●	●	●	●	●	●	B2
Olivetti DY-311	£1,322	Daisywheel	+	○		○		9600	1000	6	10,12,15	39	225	17.25	60×50	17	4	●	●	●	●			●	●	●	●	●	●	B2
Olivetti JP101	£420	Dry Ink Jet		●	+	+		9600	1000	6,8	10,12,18	50	147	9	39×26.8	5.2	1	●				●	●	●	●	●	●				B2
Olivetti TH240	£661	Thermal 5×7				+	●	9600	1000	6	10	240	80	8.75	40.1×34	7.5	1	●	●				●		●		●				B2
Olympia ESW102RO	£1,917	Daisywheel	+	+	+	●		19200	4000	6	10,12,15	24	141	17	52.8×37	13	6	●	●	●	●			●	●	●		●	●	I5
Olympia ESW103KSR	£1,263	Daisywheel	+	+	+	●		19200	4000	6	10,12,15	24	212	17	52.8×43.1	14.5	6	●	●	●	●			●	●	●		●	●	I5
Olympia ESW3000RO	£1,306	Daisywheel	○	○		○		19200	4000	3,4,6	10,12,15	50	225	17	60.4×40.8	19.5	6	●	●	●	●			●	●	●		●	●	I5
Phillips Mullard GP300	£2,287	M		+		●		19200	512	3,4,6,8,12	10,12,15	300	180	14.4	64.5×52.3	24	6	●	●	●	●	●	●	●	●	●	●	●	●	R2
Printex 920	£2,012	M		+		●		9600	1792	6,8,12,16	10,12,13.3,16.7	340	227	16	59×42.5	20	4	●	●	●		●	●	●	●			●		T3
Qume Sprint 9/35	£1,892	Daisywheel				+	1	9600	500	6,8	10,12,15	35	198	15	61.3×49.9	19	3	●	●	●	●	●	●	●	●	●	●	●	●	Q1
Qume Sprint 9/45	£1,966	Daisywheel				+	1	9600	500	3,6,8	10,12,15	45	198	15	61.7×42.5	20.4	3	●	●	●	●	●	●	●	●	●	●	●	●	Q1
Qume Sprint 9/55	£2,403	Daisywheel				+	1	9600	500	3,6,8	10,12,15	55	198	15	61.7×42.5	20.4	3	●	●	●	●	●	●	●	●	●	●	●	●	Q1
Rair Decwriter III	£2,261	M 7×7			+	●		9600	1000	2,3,4,6,8,12	5,6,6.6,8.25,10,13.2,16.5	180	132	15	69.9×60.9	46.4	3	●						●	●	●		●			R1
Rair Decwriter IV AA	£1,200	M 7×9			+	●		300	256	2,3,4,6,8,12	5 6.6 6.8 25,10,13.2,16.5	30	127	15	57.1×39.4	11.3	3							●	●			●			R1
Rair 630	£1,940	Daisywheel			+	●		9600	768	6,8	10,16.5	40	196	15	59.9×46.4	27.2	2	●		●	●		●	●	●	●	●	●	●	●	R1
Rair 820	£1,529	M 9×7			+	●		9600	1280	6,8	10,16.5	150	132	15	66×53.4	18.2	6	●		●			●	●	●	●	●	●	●	●	R1
Rair Centronics 150/4	£722	M 9×7		+		●		9600	N/A	6	10	150	132	10	38.1×35.6	9	2		●				●	●	●	●	●	●	●	●	R1
Rair/Texas Instruments 743	£1,437	Thermal				●		300	N/A	6	10	30	80	8.5	39.1×40.6	6.1	1	●										●		R1
Ricoh RP1300 Flowriter	£1,144	Daisywheel	○	○		○		9600	200	8	10,12,15	37	163	15	59.3×33.2	14	7	●	●	●	●	●	●	●	●	●	●	●	●	A1
Ricoh RP1600 Flowriter	£1,782	Daisywheel	○	○		○		9600	2000	8	10,12,15	60	163	15	62.5×35.5	22	7	●	●	●	●	●	●	●	●	●	●	●	●	A1
Ricoh RP1600S	£1,667	Daisywheel	+	+		●		9600	4000	6,8	10,12,15	65	204	13.5	63.5×36.2	27	7	●	●	●	●		●	●	●	●	●	●	●	M4
Sanders S700	£2,875	M		●		●		9600	2000	6,8	6,10,12,15,17,18	450	234	14.5	47×56.9	23.6	5	●	●	●	●	●	●	●	●	●	●	●	●	A2
Seikosha GP100A	£247	M 5×7	+	●	+	+		9600	256	6	6,12	50	80	10	42.7×23.8	4.5	3		●			●			●			●		D4
Shinwa-CTI CP80	£333.50	M 9×13		●		+		9600	132	6	11	80	142	10	295×377×125	5.3	4	●	●	●		●	●	●	●	●	●	●	●	M7
Smith Corona TP1	£557	Daisywheel		○		○		19200	N/A	3,4,5,6	10,12	120	126	13	49.5×31.5	8.4	5	●	●	●					●	●	●		●	D1
Sord SLP160	£724	M		●				9600	136	6,8,9	10,12	120	136	15	51×36	13	5	●	●	●		●	●	●	●			●	●	S12
Sord SWP20	£1,444	Daisywheel		●		+		9600	2000	6,8	10,12,15	16	132	15	66×44.7	22	5	●	●	●	●					●		●		S2
Star DP-8480	£251	M		●		+		2400	132	6,12	10,12,16.7	100	132	10.5	39.4×32.4	8.5	2	●			●		●	●	●	●	●	●	●	S3
Star DP-510	£333,50	M 9×9		●	+	+		9600	2,300	6,8	10,12,17	100	132	10	315×392×136	7	3	●	●	●	●	●	●	●	●	●	●	●	●	M7
Star DP-515	£460	M 9×9		●	+	+		9600	2,300	6,8	10,12,17	100	233	15	515×542×136	10	3	●	●	●	●	●	●	●	●	●	●	●	●	M7
Systime Systerm	£1,909	M					●	9600	256	6,8	10	120	132	16	71.7×61	53	6				●		●	●	●	●	●	●	●	S4

Systime Sysprint-P	£1,714	M		●				9600	256	6,8	10	150	132	16	71.7×61	50	6		●		●		●	●			●		S4
Systime Sysprint-S	£1,599	M				●		9600	256	6,8	10	120	132	16	71.7×61	53	6		●		●		●	●			●		S4
Tandy TRS 80 DW2	£1,299	Daisywheel		●				9600	2000	6	10,12	43	163	16.5	62.4×20.4	27	4	●	●	●	●			●	●		●	●	T1
Texas Instruments 743	£1,271	Thermal 7×5			●	●		300	N/A	6	10,17	30	80	8.5	39.1×40.6	6	1								●		●		D5
Texas Instruments 745	£1,470	Thermal				●		300	256	6	10,17	30	80	8.5	39.1×40.6	13.5	1								●				R1
Texas Instruments 781	£1,259	Thermal 7×5			●	●		9600	256	6	10,17	120	80	8.5	40.6×15.24	8.5	1							●	●		●		D5
Texas Instruments 810	£1,369	M 9×7		+	+	●		9600	256	6,8	5,8,10,16.5	150	132	15.5	65.4×50.8	25	9							●	●		●		D5
Texas Instruments 820	£1,438	M 9×7			○	○		9600	2000	6,8	5,8,10,16.5	150	218	15.5	64×45.7	40	5							●	●		●		D5
Texas Instruments 840	£847	M 9×9			+	●		9600	256	6,8	10,16.5	75	220	15	57.6×43.2	11.3	3							●	●	●	●	●	R1
TRD 170S	£834	Daisywheel		○		○		19200	256	6	10,12,15	17	132	15.5	50.8×33	13	6	●	●	●	●			●	●				T2
Toshiba T1350	£1,898	M		○		○		9600	256	6	10,12	192	192	15	55×38	19.9	3	●	●	●	●	●	●	●	●	●	●	●	T4
Walters WM2000	£477	M 9×9	+	●	+	+		19200	750	6,8,12	5,6,6,8,3,10,13.3,16.6	128	132	10	43.9×33.5	12	4	●	●	●		●	●	●			●		W1
Walters WM4000	£713	M 9×9	+	●	+	+		19200	1500	6,8,12	5,6,6,8,3,10,13.3,16.6	150	220	15	63×39	13	5	●	●	●		●	●	●			●		W1
ZX Printer	£40	Electrical					1	N/A	N/A	9	32	50	32	4	14×4.6	N/A	1			●		●	●			●		●	S5

MONITORS

These have been split into **colour** and **monochrome.**

Screen size is a diagonal measurement in inches. Nearly all monochrome monitors accept a **composite video** signal from the computer and most computers are equipped with composite video output. Colour monitors feature a wider range of **signal** systems than mono and it is important to match the output of your computer to the input of the monitor.

An **audio channel** will enable sound to be output from a speaker inside the monitor. **Mono tint** refers to the colour of the text on a mono monitor. Some monitors come with an **anti-glare filter** to relieve operator discomfort.

Band width refers to the frequency range of signals to which the monitor can respond in MegaHertz. **Dot resolution** indicates the number of dots which can be displayed across the screen: the more dots, the sharper the picture.

Dimensions indicates the area the unit occupies on the desktop.

COLOUR MONITORS

Make & Model	Price inc VAT	Screen size (in inches)	Signal: Modulated PAL	Signal: Unmodulated PAL	Signal: TTL RGB	Signal: 75 Ohm linear	Signal: 32 bit 4 bit TTL	Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
Crofton C1401	£300	14			●					10	600	37×42	10	C4
HM 2713	£3,120	13			●					25	720	54×40	36	B1
HM 2719B	£2,553	19			●					25	960	50×49	46	B1
HM 2719C	£3,042	19			●					25	960	50×49	46	B1
HM 3619	£3,548	19			●					45	1280	50×44	48	B1
Kaga Vision II	£327.75	12			●				●	15	510	32×30.3	12.5	D6
Lion Cub 1431-TTL	£286	14			●					7	585	65×57.5	11.5	S6
Lion Cub 1436	£316	14					●			7	585	65×57.5	11.5	S6
Lion Cub 1439	£339	14				●				7	585	65×57.5	11.5	S6
Lion Cub 1441-TTL	£546	14			●					15	585	65×57.5	11.5	S6
Lion Cub 1445	£633	14				●	●			15	895	65×57.5	11.5	S6
Lion Cub 1449	£604	14				●				15	895	65×57.5	11.5	S6
Lion Cub 1451-TTL	£430	14			●					10	653	65×57.5	11.5	S6
Lion Cub 1455	£483	14				●	●			10	653	65×57.5	11.5	S6
Lion Cub 1459	£459	14				●				10	653	65×57.5	11.5	S6
Lion Cub 2031-TTL	£344	20			●					7	585	65×57.5	11.5	S6
Lion Cub 2035	£431	20				●	●			7	585	65×57.5	11.5	S6
Lion Cub 2036	£390	20					●			7	585	65×57.5	11.5	S6
Lion Cub 2039	£371	20				●				7	585	65×57.5	11.5	S6
Lion Cub 2051-TTL	£646	20			●					10	940	65×57.5	11.5	S6

Make & Model	Price inc VAT	Screen size (in inches)	Signal: Modulated PAL	Signal: Unmodulated PAL	Signal: TTL RGB	Signal: 75 Ohm linear	Signal: 32 bit 4 bit TTL	Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
Luxor Digital	£574	14			●				●	25	800	N/A	15.7	P1
Luxor Linear I	£597	14				●			●	25	800	N/A	15.7	P1
Luxor Linear II	£643	14			●				●	25	800	N/A	15.7	P1
Microtech 14	£402	14		●	●	●			●	18	585	33.7 × 40.8	12.6	M6
TM 22	£329	6				●			●	5.5	N/A	22×34.5	4.1	J3
VM 14 PSN	£378	14				●			●	5.5	300	47×40	13.6	J3
Wolf Cub 1435-TTL	£358	14				●	●			7	653	65×57.5	11.5	S6
Wolf Cub 1446-TTL	£587	14					●			15	895	65×57.5	11.5	S6
Wolf Cub 1456	£454	14					●			10	653	65×57.5	11.5	S6

MONOCHROME MONITORS

Make & Model	Price inc. VAT	Screen size	Composite video	Audio channel	Mono tint	Anti-glare filter	Band width (MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
AVT DM 210G	£138	12	●		Green	●	12	750	30.8×29.6	9.5	L1
EG 100	£77	12	●		Green		8	700	37.5×29	8	L1
EG 101	£91	12	●		Green		12	700	37.5×29	8	L1
LEDM 091D	£99	9	●		B&W	●	12	750	22×24	5.4	L1
LEDM 0910	£121	9	●		Green	●	12	750	22×24	5.4	L1
Luxor 10	£212	10	●		Orange	●	22	625	N/A	8	P1
Luxor 15	£283	15	●		Orange	●	22	625	N/A	13	P1
M9	£131	9	●		Green		15-22	650	22.4×25.7	5.7	P1
M12	£144	12	●		Green		15-22	800	29.3×30	9.3	P1
Novex	£114	12	●		Green		12	750	N/A	N/A	P1
N12 1003	£112	12	●		Green		24	800	23×26.5	7	P1
Prince	£126	12	●		Green		24	800	33×50	7	C4
PM 102	£126	9	●		Green	●	24	800	22×28	7	C4
PM 1201	£138	12	●		Green		24	800	33×50	7	C4
Zenith ZVM121	£99	12	●	●	Green	●	15	N/A	29×29	6.5	P2
U300	£149	12	●		Green	●	18	N/A	34·8×36·8×29·2	7·7	R4
U300A	£153	12	●		Amber	●	18	N/A	34·8×36·8×29·2	7.7	R4

DISK DRIVES

This section is divided into categories covering 5¼in and 8in floppy disks.

Disk data **capacity** is measured in kilobytes (K): one kilobyte = 1,024 characters. A **no of disks** column is included because some disk units contain two disk drives.

Manufacturers can vary the number of disk data **tracks** and these are divided into sectors. This **sectoring** system allows the information to be stored and retrieved by reference to a timing mark on the disk so the computer can keep track of its rotation. The system can be hard, where reference is kept by a hole in the disk, or soft, where the disk position is monitored by magnetic signals.

Some drives have one read/write head for each side of the disk so the buyer has a choice between **single or double-sided** drives. **BS** means that the drives are both single and double-sided.

As disk technology advanced it became possible to cram more data onto the floppy so drives will feature either **single or double** (data) **density. BD** means that the drives are both single and double density.

The interface acts as an interpreter so the computer and disk can exchange information. Each device must have the same interpreter before a useful cable connection can be made. The **connect to** column allows you to match the disk interfaces to those included in the disk drives or available at extra cost.

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
5¼" DISK DRIVES																
Apple II	£399	143K	1	35	16	SS.SD				●						P2
Atari	£299	90K	1	40	Soft	SS.SD									●	A4
BASF 6106	£195	500K	1	48	Both	SS.BD					●					B6
BASF 6108	£240	500K	1	48	Both	DS.BD					●					B6
BASF 6118	£279	1Mb	1	96	Both	DS.BD					●					B6
Canon X8300	£600	640K	2	80	Soft	DS.DD									●	C5
CD 40	£679	400K	2	40	Both	SS.BD									●	C6
CD 50A	£424	500K	2	40	Both	SS.BD					●					C6
CD 50E	£569	1Mb	2	80	Both	SS.BD					●					C6
CD 50F	£712	2Mb	2	80	Both	DS.BD					●					C6
CD 80	£765	800K	2	80	Both	SS.BD									●	C6
CD 80D	£949	1.6Mb	2	80	Both	DS.BD									●	C6
Commodore 2031	£454	171K	1	35	Soft	SS.DD	●									C2
Commodore 4040	£799	343K	2	35	Soft	SS.DD	●									C2
Commodore 8050	£1,029	1Mb	2	77	Soft	SS.DD	●									C2
Commodore 8250	£1,489	2Mb	2	154	Soft	DS.DD	●									C2
Commodore VIC 1541	£345	171K	1	35	Soft	SS.DD									●	C2
Control Data 9408	£221	250K	1	40	Both	SS.BD					●					C7
Control Data 9409	£272	500K	1	40	Both	DS.BD					●					C7
Control Data 9409T	£420	1Mb	1	80	Both	DS.BD					●					C7
Control Data ZL141	£225	250K	1	40	Both	SS.DD			●							M5
Control Data ZL141B	£175	250K	1	40	Both	SS.DD			●							M5
Control Data ZL142	£360	500K	2	40	Both	SS.DD			●							M5
Control Data ZL241B	£240	500K	1	40	Both	DS.DD			●							M5
Control Data ZL291	£380	1Mb	1	80	Both	DS.DD			●							M5
Control Data ZL291*	£405	500/1Mb	1	40/80	Both	DS.DD			●							M5
Control Data ZL291B	£320	1Mb	1	80	Both	DS.DD			●							M5
Control Data ZL292	£640	2Mb	2	80	Both	DS.DD			●							M5
CS 40	£482	200K	1	40	Both	SS.BD									●	C6
CS 50A	£229	250K	1	40	Both	SS.BD					●					C6
CS 50E	£305	500K	1	80	Both	SS.BD					●					C6
CS 50F	£397	1Mb	1	80	Both	DS.BD					●					C6
CS 80	£523	400K	1	80	Both	SS.BD									●	C6
CS 80D	£627	800K	1	80	Both	DS.BD									●	C6
Cumana AS100	£252	200K	1	35	Soft	SS.BD				●						C6
Cumana DA8035	£857	655K	2	80	Soft	SS.BD				●						C6
EG 401AT	£370	102K	2	40	Soft	SS.BD					●					L1
Gemini 825	£403	400K	1	80	Soft	SS.DD						●				G2
Gemini 825	£518	800K	1	160	Soft	DS.DD						●				G2
Gemini 825	£661	800K	2	80	Soft	SS.DD						●				G2
Gemini 825	£776	1.6Mb	2	160	Soft	DS.DD						●				G2
Lowe EG 400AT	£426	200K	2	40	Soft	SS.BD					●					L1
Lowe EG 400T	£253	102K	1	40	Soft	SS.BD					●					L1
M 4853	£311	1Mb	1	80	Soft	DS.DD					●					A3
M 4854	£368	1.6Mb	1	77	Soft	DS.DD					●					A3
Megastore MIOS	£1,034	1.2Mb	2	80	Soft	DS.DD				●					●	V1
Multi Floppy Drive	£592	8Mb	5	770	Soft	SS.DD	●									H1
RM MDS-1	£1,950	144K	1	40	Soft	DS.SD		●							●	R3
RM MDS-2	£2,147	288K	2	40	Soft	DS.SD		●							●	R3
Scorpio 8	£863	8Mb	5	770	Soft	SS.DD	●									H1
Sharp MZ80 FB	£856	560K	2	70	Soft	DS.DD									●	S7
Tandy Colour	£449	175K	1	40	Soft	DS.DD									●	T1
Tandy 26-1160	£299	75K	4	40	Soft	SS.SD					●					T1
Tandy 26-3023	£299	156K	4	35	Soft	SS.DD					●					T1
Tandy Model 1	£389	90K	1	35	Soft	SS.SD									●	T1
Tandy Model 111	£369	175K	2	40	Soft	SS.DD									●	T1
TM 101-4	£282	1Mb	1	160	Soft	SS.DD	●									H1
TM 102-2	£393	2Mb	1	160	Soft	SS.DD	●									H1
TM 848-1	£389	800K	1	77	Soft	SS.DD	●									H1
TM 50-1	£147	250K	1	40	Soft	SS.DD	●									H1
TM 100-1	£158	250K	1	40	Soft	SS.DD	●									H1
TM 100-2	£221	500K	1	80	Soft	DS.DD	●									H1
TM 100-4/4M	£247	1Mb	1	160	Soft	DS.DD	●									H1
Tracker 1	£373	1Mb	2	80	Soft	SS.DD					●					D7
Tracker 2	£497	2Mb	2	80	Soft	DS.DD					●					D7

Make and Model	Price inc VAT	Capacity	No. of discs	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
8" DISK DRIVES																
ACP 700 (AC)	£293	1Mb	1	77	Soft	DS.DD									●	E2
ACP 750 (DC)	£316	1Mb	1	77	Soft	DS.DD									●	E2
ACP 1500 (DC)	£403	2Mb	1	77	Soft	DS.DD									●	E2
Caldisk 142M	£465	500K	1	77	Both	SS.BD									●	E2
Caldisk 143M	£522	1.2Mb	1	77	Both	DS.BD						●				F1
Caldisk 143M-1	£465	500K	1	77	Both	SS.BD						●				F3
Commodore 8280	£2,760	987K	2	77	Soft	DS.DD	●									C2
Canon X 8330	£1,200	2Mb	2	153	Soft	DS.DD									●	C5
Control Data 9404B	£684	800K	1	77	Both	SS.BD						●				M5
Control Data 9406-4	£1,144	1.6Mb	1	77	Both	DS.BD						●				M5
Eicon FD8/1D/DD	£1,438	1Mb	1	77	Soft	SS.DD					●					E3
Eicon FD8/1D/SD	£1,397	500K	1	77	Soft	BS.SD					●					E3
Eicon FD8/2D/FBR	£1,740	1Mb	2	77	Soft	DS.SD									●	E3
Eicon FD8/2D/DD	£2,013	2Mb	2	77	Soft	SS.DD					●					E3
Eicon FD8/2D/SD	£1,972	1Mb	2	77	Soft	SS.SD					●					E3
Eicon FD8/1D/FBR	£1,240	500K	1	77	Soft	DS.SD									●	E3
F 311	£1,725	1.2Mb	2	76	Soft	DS.SD									●	B5

8" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nutshus	Gemini	20ma	Others	Distributor
F 320	£2,300	2.4Mb	2	76	Soft	DS.DD									●	B5
M 2894	£499	1.6Mb	1	77	Soft	DS.DD				●						A3
M 2896	£493	1.6Mb	1	77	Soft	DS.DD				●						A3
Megastor 11 DD	£1,133	2Mb	2	77	Soft	DS.DD			●							V1
Megastor 11SD	£1,018	1Mb	2	77	Soft	DS.SD			●						●	V1
Megastor 111	£1,121	2Mb	2	77	Soft	DS.DD			●						●	V1
R.M. FDS-2	£3,789	1Mb	2	77	Soft	DS.SD	●								●	R3
Tandy Model 11	£999	486K	1	77	Soft	DS.SD.									●	T1
Tandy Model 16	£949	1.2Mb	1	77	Soft	DS.DD									●	T1
Tandy Model 16	£1,549	2.5Mb	2	77	Soft	DS.DD									●	T1

MODEMS

A modem interfaces a computer and the telephone system so computers can communicate over long distances. It converts data to electrical pulses or sounds that can be sent down the line. A modem can be connected to the line directly or acoustically. A **D** in the **connection** column represents direct link, while **A** indicates acoustic. The acoustic coupler is like a female telephone handset with a speaker in the coupler opposing the phone's mouthpiece and a microphone opposing the earpiece. A **B** in this column indicates that both methods of attachment are available. **Baud** rate shows the speed with which the data is transmitted.

The modem must be connected to the computer through an interface. The **interface** column lists the main interfaces featured on each modem. **Asynchronous** means that data may be transferred at intervals as available or as needed. **Synchronous** data is transmitted at regular intervals. **Simplex** transfers data in one direction, while **Half duplex** can transmit/receive in either direction, but not simultaneously. **Full duplex** transmits and receives information in both directions at once. Some modems can **originate** a call or start a two-way conversation. **Answer** means they can respond to a call from another computer.

Make and Model	Price inc VAT	Connection	Data Rates (baud)	Interface	Others	Capabilities: Asynchronous	Synchronous	Simplex	Half Duplex	Full Duplex	Originate	Answer	Distributor Code
AD 1223	£287.50	D	1200	RS232		●			●		●	●	A6
AJ 311	£320	B	300	RS232		●			●	●	●	●	A5
AJ 1222	£736	D	1200	RS232		●	●			●	●	●	A5
AJ A211	£263	A	300	RS232		●			●	●	●		A5
AJ 1234	£684	A	1200	RS232		●	●			●	●		A5
AJ 1256	£684	B	1200	RS232		●	●			●	●	●	A5
AM 211	£387	B	300	RS232		●			●	●	●		A5
Bermac 1200/1 Model A	£414	D	1800	RS232			●			●		●	B3
Bermac 1200/1 Model B	£460	D	1800	RS232			●			●		●	B3
CCITT CAT	£228	A	300	RS232/V24			●			●	●	●	D8
CDSV22	£719	D	1200	RS232/V24			●	●			●	●	D8
DSL2123	£329	D	300/1200	RS232/V24			●			●	●	●	D8
Sendata 700 Series A	£253	A	300	RS232, 20ma	1		●				●	●	B4
Sendata 700 Series B	£224	A	300	RS232, 20ma	1		●				●		B4
Sendata 700 Series C	£309	A	600-1200	RS232, 20ma	1		●			●		●	B4
Sendata 700 Series D	£309	A	75-1200	RS232, 20ma	1		●				●	●	B4
Sendata 700 Series E	£149	A	300-1200	RS232, 20ma	1		●		●				B4
Racal 126 LS1	£782	D	2400	V24				●		●	●	●	R2
Racal MPS 3021	£295	D	300	V24			●			●	●	●	R2
Racal MPS 1222	£678	D	1200	V24			●	●		●	●	●	R2

PLOTTERS

Plotters use a pen to put graphics or characters on paper under the command of a computer. They are usually one of two types—flatbed or drum. A **flatbed** holds the paper flat while the pen draws on it in two dimensions. A **drum** plotter turns the paper vertically on a cylinder while the pen moves horizontally. Most plotters can change pens during operation so a variety of colours and line thicknesses are available. **Max pens** indicates the number of pens in operation or on standby. Dimensions of the paper to be used are listed under **paper size. Maximum plotting speed** measures the distance in millimetres per sec covered by the pen. **Interfaces** are included in the basic price or come at extra cost.

Make and Model	Price inc VAT	Type	Max Pens	Paper Size	Maximum Plotting Speed in secs.	Interface (+ all extra cost)	Distribution
Calcomp 81	£3,392	Flat	8	A3	30cm	RS232 or IEEE	C3
DXY 100	£699	Flat	1	A3	7	Centronics	R4
HP 7470A	£1,317	Drum	2	A4	38.1cm	RS232 (IEEE+)	H2
PD4	£585	Flat	1	A4	700mm	(IEEE+)	J2
RY-21	£747.50	Flat	1	A4	200mm	Centronics, (RS232+)	R5
RY-10MZ	£1,865	Flat	8	A3	400mm	Centronics, (RS232, IEEE+)	R5
Strobe 100	£662	Drum	1	A4	7.6cm	(RS232, Parallel+)	D6
TRS-80 Pen Plotter	£1,399	Flat	6	A4	6.8cm	RS232	T1
Watanabe WX 4634	£2,515	Flat	2	A3	250mm	(Centronics, RS232, IEEE+)	E4
Watanabe WX 4635	£2,301	Flat	1	A3	250mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4637	£2,862	Flat	2	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4638	£2,635	Flat	1	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe WX 4671	£1,129	Flat	1	A3	50mm	Parallel (RS232, IEEE+)	E4
Watanabe 4675	£1,638	Flat	6	A3	50mm	Parallel (RS232, IEEE+)	E4
Watanabe 4731	£1,761	Drum	4	A3	200mm	(Centronics, RS232, IEEE+)	E4

DISTRIBUTORS

A1 Appropriate Technology, 01-625 5575 **A2** Advent Data Products, Melksham 706289 **A3** Altex Microcomputers Ltd, Reading 791579 **A4** Atari International (UK), Slough 33344 **A5** Anderson Jacobson Ltd, Slough 25172 **A6** Alpha Datasystems, 058 27 66136

B1 Bytech, Reading 61031 **B2** British Olivetti, 01-785 6666 **B3** Barron McCann, Biggleswade 316286 **B4** Bencom Sendata (UK), 01-940 1386 **B5** Baydel Ltd, Leatherhead 378811 **B6** BASF, 01-388 4200

C1 Centronics, 01-581 1011 **C2** Commodore Business Machines, Slough 79292 **C3** Calcomp Ltd, Bracknell 50211 **C4** Crofton Electronics, 01-891 1923 **C5** Canon (UK) Ltd, 01-680 7700 **C6** Cumana, Guildford 503121 **C7** CBL, Reading 792097

D1 Discom, Evesham 3591 **D2** Datatrade Ltd, Northampton 22289 **D3** DNCS Ltd, 061-643 0016 **D4** DRG, Weston-super-Mare 415398 **D5** Data Systems Division, Bedford 223889 **D6** Data Efficiency, Hemel Hempstead 63561 **D7** Data Track Technology, New Milton 619650 **D8** Dacom Systems, Milton Keynes 676797

E1 Epson (UK), 01-900 0466 **E2** Elecomatic, 041-881 5825 **E3** Eicon, Barhill 81825 **E4** Environmental Equipments Northern Ltd, Nantwich 625115

F1 Fastcol, Reading 791557

G1 Geveke Electronics, Woking 26331 **G2** Gemini Micros, Amersham 28321

H1 HAL Computers Ltd, Farnborough 517175 **H2** Haywood Electronic Asoc. Ltd, 01-428 0111

I1 Informex Ltd, 01-318 4213 **I2** Intac Data Systems, Rotherham 54717C **I3** ITT Business Systems, Brighton 507111 **I4** ITT Consumer Products, Basildon 3040 **I5** Intelligent Interfaces, Stratford-upon-Avon 296879

J1 Jones & Brother, 061-330 6531 **J2** J J Lloyd Instruments, Lockseath 4221 **J3** JVC, 01-450 2621

L1 Lowe Electronics, Matlock 4995

M1 Mitsui & Co Ltd, 01-600 1777 **M2** Modata, Tunbridge Wells 41555 **M3** Mannesmann Tally Ltd, Reading 788711 **M4** Micropute, Macclesfield 615384 **M5** Microware, 01-272 6237 **M6** Microtech Leeds, Leeds 679964 **M7** Micro Peripherals Ltd, Basingstoke 3232

N1 Newbury Data Recording, Newbury 48864

P1 Phoenix Technology, 01-737 3333 **P2** Pete & Pam Computers, Rossendale 227011

Q1 Qume (UK) Ltd, Reading 584646

R1 Rair Ltd, 01-836 6921 **R2** Riva Terminals, Woking 71001 **R3** Research Machines Ltd, Oxford 249866 **R4** Roland (UK) Ltd., 01-568 4578 **R5** Rikadenki Mitsui Electronics, 01-397 5111

S1 Sintron Electronics, Reading 875464 **S2** Sord, 01-930 4214 **S3** Stotron, Coventry 613521 **S4** Systime, Leeds 70221! **S5** Sinclair Research, Camberley 681666 **S6** Silicon Express, Leicester 374917 **S7** Sharp Electronics, 061-205 2333

T1 Tandy Company, Walsall 648181 **T2** Triumph Adler, 01-250 1717 **T3** Technology For Business, 01-837 1271 **T4** Toshiba Office International, Sunbury-on-Thames 85666

V1 Vlasak, High Wycombe 448633

W1 Walters Microsystems Int Ltd, High Wycombe 445175

X1 X-Data Ltd, Slough 723331

Z1 Zygal Dynamics, Bicester 3361

PCN Billboard

Spectrum Software for sale. (All originals) 15 titles. 75% of cost price. Including, TranzAm , Arcadia, Pssst. Tel: 0358 20957 after six — ask for Michael.

Would Mike Norris, author of 'Dragon World' and K. Hussey, author of BBC 'Music Maker' please phone Surya at PCW as soon as posible. Thanks.

Video Genie 16K, manuals, leads, light pen, (Kansas) arcade games and utilities worth £160, good condition, must sell, value £525 will accept £275 ono. Tel: 01-808 6522.

Atari VCS, plus ten games, Space Invaders, Combat, Basketball, Shoot Out, etc. Joysticks, £120 ono. 12 Weavers Terrace, Micklethwaite Road, Fulham, London, SW6 1QE. Tel: 01-381 3290.

Atari 400 with Basic, 410 program recorder, programmer system, all under guarantee, joysticks, software includes EMI Soccer and more, £250 ono. Tel: Shotts 23227.

Philips G7000 with six cartridges including Conquest of the World, Freedom Fighters and Munchkin, £110. Tel: Bollington 75114.

Atari VCS, three cassettes including Asteroids and Missile Command, will accept £80 ono. Tel: Leeds 664194 after 4pm.

HP 41C calculator with Statistics Pac, Optical Wand and Test Statistics Pac, calculator hardly used, Wand never used. Cost £265, sell for £175. Tel: Slough 31959.

Acorn Atom 12K+12K, floating point, 4K Eprom,, £50 software including Snooker, Asteroids, and Defender, book, manuals, PSU, all leads. Tel: Framfield (082582) 623.

Korg MS10 synthesizer as new, with guarantee, swop for BBC computer in good condition. £200. 36 Sunningdale Avenue, Lowestoft, Suffolk. Tel: (0502) 64729.

ZX81 16K QS character board, £s of software, Krazy Kong, Puckman, Invaders, Scramble, Tempest etc, manual and all leads, vgc, only £100. Tel: 01-368 4653.

Swop Sharp Pocket Computer and cassette interface, plus 35mm camera and lenses, for T199/4A minimemory, or sell for £70 ono. Tel: 021-749 2662.

Sharp PC 1211 with printer — cassette interface and manuals, £130 or swop for Spectrum 48K. Tel: Norwich (0603) 57304.

TRS-80 Model one Level two + interface, monitor, 48k RAM and high res graphic unit + software, cassette recorder and books. Sell for £600. Tel: 061-368 7145.

Ohio superboard, faulty, £55. Wanted floppy for Nascom or UK101 also printer and Nascom utilities, cheap Spectrum. Hugh Bridge, 363 Kennington Lane, London SE11.

Commodore 64 games: Matrix, Laser Zone, Attack of the Mutant Camels, Motor Mania, Super Skramble, £5 each. Also Witness (disk), £20. Tel: 01-642 6553.

48K tandy Model 1, green monitor, dual disks, word processing, Visicalc, Pascal, LDOS, TRSDOS, £490 ono. With Centronics 737 printer, £750. Tel: 01-445 5724.

Vic 20, 16K RAM, C2N cassette, joystick, reference guide, program aid, four software cartridges + tapes including Panic Blitz. All in excellent condition, will sell for £175 for quick sale. Tel: 061-736 1534 after 6pm.

Commodore 64, two months old, boxed, lots of software and books and tape drive, £255. Also G7000, eight games, £80. Tel: Nigel on (0584) 4235 after 8.30pm.

Philips G7000, boxed, with nine games cartridges, perfect condition, £125. Tel: 01-455 3608.

Oric software: Oric Flight, Chess, Multigames, Zodiac. A+F Adventure Salamender games compendium. All half price or offers for the lot. Tel: Tottington 7109.

Spectrum software, Leapfrog, Horace, Raiders, Mined Out, Orbiter, Skiing, Horace and The Spider Quest. Worth £40, sell £15. Tel: Huntingdon 56789 or SAE to 32 Huntingdon Road, Brampton, Cambridgeshire.

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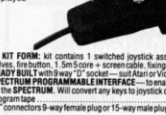

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Salary: £11079 to £11673 (SO2)

The aim of this challenging and demanding job is to set up the workshop and establish it as a going concern.

The successful person for this post of Deputy Centre Manager will be responsible for the daily management and development of the workshop in all its aspects and will be managing a staff team who will develop and carry out a training programme in the use of micro-computers, aimed at teaching communication and work skills. Individual assessments of the needs of each participant will be an important part of the task.

Previous experience of micro-computers and their application is required, as is a real interest or experience of the problems of physically handicapped people.

The Micro Workshop Co-ordinator will be one of 2 Deputies to the Centre Manager, the other Deputy is responsible for development of care activities. The Centre Manager will delegate to his Deputies responsibilities on a daily basis and specific responsibilities in his absence.

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Classified

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- **Dragon Word Processor,** cassette based system, 20K text buffer, full manual included, £10. R. J. Crowther, 141 Hollyfield, Harlow, Essex CM19 4ND.
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SYNTAX ERRORS

Disk count

Prices got a little garbled in our account of Research Machines' new disk drives for the Link 480Z (*PCN, issue 25*). The single drive costs £708, not £725, and the dual drives are £1,062, not £1,087.

These prices include VAT.

RML's phone number also suffered — it should be 0865 249866.

NEXT WEEK

***Exclusive* — PCN gives the Dragon disk drives a spin.**

***Hardware* — Portico's Miracle on the threshold and on the cover.**

***Software* — Programming on the TI 99/4A.**

***Peripherals* — a light-pen to lighten the Apple.**

***Micropaedia* — Part 3 of the Dragon dissection.**

***Gameplay* — a sporting chance on the Oric, Commodore 64, BBC and Spectrum systems.**

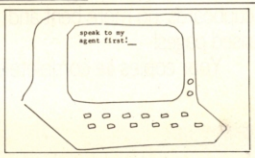
***Plus* the PCN Charts, book reviews, news, regular features and more . . .**

Bear baiting

The Soviet Union normally as impervious to criticism as IBM, will be shaken by the prompt action of Personal Software Services (PSS) of Coventry in the wake of the Korean Jumbo incident. In a statement to the press last week PSS announced it has decided to break off all trading relations with the Soviet Bear for the next 60 days. But before Yuri Andropov breaks into a cold sweat at the possible consequences for the Russian economy, we should point out that for both PSS and the USSR the next 60 days will in all important respects resemble the last 60. PSS has never, as far as we can tell, had any trading relations with the Soviet Union.

Laughline

What are Wendy Craig and Cliff Michelmore scratching their heads about outside Acorn's home of the future (packed with Electrons)? Have they been waiting six months for the front door key? Are they composing an angry letter to the supplier of the windows? Put the words into their mouths, and the funniest entry, received by September 29, will win £20.



PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
Video, Audio and Computer Show	Sep 16-18	Bradford Exposition Centre	R. Cooper, J. Wood & Sons Ltd, Bradford 720014
BBC Micro User Show	Sep 16-18	Sherwood Rooms, Greyfriar Gate, Nottingham	Database Publications, 061-456 8383
Second National British Osborne Owners' Group Meeting	September 17	National Liberal Club, 1 Whitehall Place, London SW1	Dr J. Anglesea, 021-472 1311 Ext 275
Home Entertainment Show	Sep 17-25	Olympia, London	Montbuild Ltd, 01-486 1951
Kent Apple Village	September 18-21	Stour Centre, Ashford, Kent	Database Publications, 061-456 8383
Computer Open Day Exhibition	September 22	Central Hotel, Glasgow	Couchmead Communications Ltd, 01-778 1102
Microcomputers in Business	Sep 27-29	Warwick University, Coventry	Peter Bubb, 01-892 4422
IWP one-day workshop	Sep 29	City Conference Centre, 76 Mark Lane, London EC3	Quadrilect, 3 Courtfield House, Baldwin Gardens, London EC1, 01-242 8697
Personal Computer World Show	Sep 29-Oct 2	Barbican Centre, London	Montbuild Ltd, 01-486 1951
Computer Fair	Oct 2	The Sir Frederic Osborn School, Welwyn Garden City	R Brown Welwyn Garden City 23367
Lancaster & Morecambe Computer Club Open Day	Oct 29	Lower Town Hall, Lancaster	Brian Sheldon, 0524 61831

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Australian Computer Exhibition	Sep 13-16	Melbourne, Australia	Riddell Exhibition Promotions PTY Ltd, 166 Albert Road, South Melbourne, Vic 3205
Computex	Sep 20-22	Limerick, Republic of Ireland	SDL Exhibitions, Dublin 763871
Info '83	Oct 10-13	New York, USA	Cahners Exposition Group, 0483 38085
Computer Systems International Trade Fair & Congress	Oct 17-21	Munich, West Germany	ECL Exhibition Agencies, 01-486 1951

Announcing more exciting programs for the BBC.

Acornsoft is the software division of Acorn Computers, the company that designed and built the BBC Microcomputer. Here are four more exciting programs, all designed to get the most from your BBC Micro.

Starship Command (£9.95) is a demanding high-resolution graphics game in which you command a starship against attacking alien ships. You control the forward drive and rotational thrust of your ship, which is equipped with shields, long and short-range scanners and a sector display of the stars and alien ships.

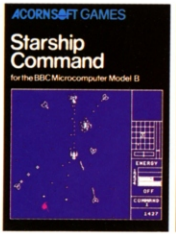
Countdown to Doom (£9.95) is a race against time as you strive to repair your damaged space ship in the corrosive atmosphere on the planet Doomawangara (Doom). Beat the clock or resign yourself to a life in the wilderness of Doom.

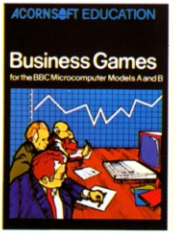
Business Games (£9.95) is a cassette containing two games designed for economics, business or general studies teaching.

In Stokmark, up to eight players compete in buying and selling shares aided by a screen display of relevant market information.

In Telemark, players compete to dominate in the manufacture and sale of televisions. The winner is the one who makes the largest profit or controls over half the total market.

Jars (£11.90) is an educational cassette suitable for 7-13 year olds. The objective of the program is to present, what are usually thought of as purely numerical problems, in a visual way. Jars of liquid are used to visualise volume estimation and fraction problems. Success, partial success or failure is noted by a scoring system and suitable comments.





How to get Acornsoft programs.

If you're a credit card holder and would like to buy cassettes of the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy the cassettes directly by sending off the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

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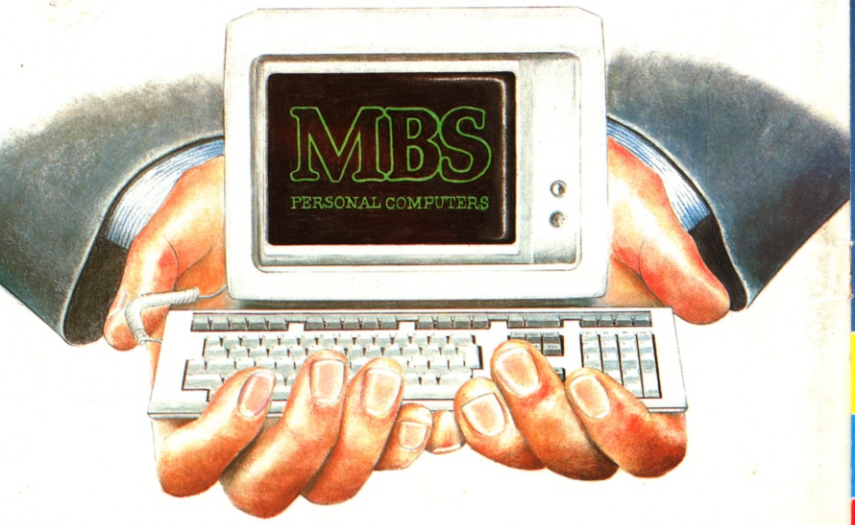

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